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# MEMORIE DELLA SOCIETÀ ENTOMOLOGICA ITALIANA

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**Volume 85**

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2006

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Supplemento al Bollettino della Società Entomologica Italiana 138 (2) (15.07.2006)

15 luglio 2006



SOCIETÀ ENTOMOLOGICA ITALIANA via Brigata Liguria 9 Genova



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# SOCIETÀ ENTOMOLOGICA ITALIANA

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Volume 85

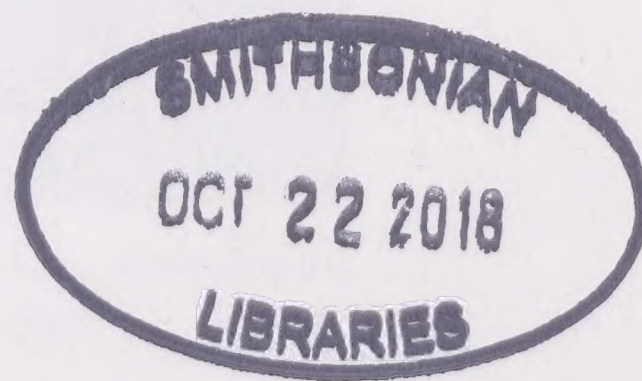
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2006

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Pubblicato con il contributo del Ministero per i Beni e le Attività Culturali



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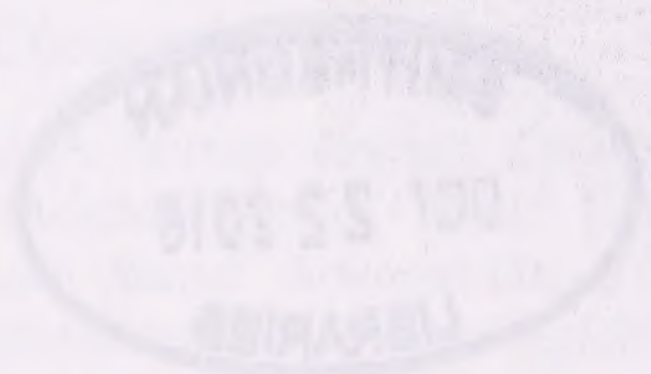
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**Volume  
in memoria di  
Mario Enrico Franciscolo**

**a cura di:  
Gianluca Nardi**





Roberto POGGI

## Bibliografia di Mario Enrico Franciscolo

**Riassunto** - Si fornisce l'elenco completo delle pubblicazioni scientifiche stilate da Mario E. Franciscolo e dei nuovi taxa da lui descritti.

**Abstract** - *The bibliography of Mario Enrico Franciscolo.*

The scientific papers written by Mario E. Franciscolo are listed, together with the new taxa described by him

**Key words:** Coleoptera, bibliography, list of described new taxa, Mario E. Franciscolo: biographical data.



Fig. 1. Mario Franciscolo a Genova Molassana (Castelluzzo),  
il 13.IV.1979 (foto N. Sanfilippo).

### INTRODUZIONE

Mario Enrico Franciscolo (Genova, 9 agosto 1923 - 28 ottobre 2003), pur svolgendo la sua attività professionale nel campo dell'industria petrolifera ed avendo spiccati



interessi per la musica, la balistica forense e la caccia, si è occupato per tutta la vita di entomologia e di speleologia.

Diplomato al Liceo Classico "Andrea D'Oria" di Genova nel 1942, laureato in Scienze Naturali all'Università di Genova nel 1951, libero docente in Entomologia nel 1964 e confermato nel 1969, è stato socio della Società Entomologica Italiana per 65 anni, dal 1939 al 2003; nominato Socio Onorario nel 1984, fu eletto Vice Presidente a partire dal 1996; nel 2001 fu inoltre chiamato a far parte dell'Accademia Nazionale Italiana di Entomologia, come Accademico Ordinario.

Tra le disposizioni testamentarie lasciate al cugino Roberto Tortello, il Prof. Franciscolo ha espresso la volontà di non essere oggetto di commemorazione in alcuna forma; rispettando questa richiesta, pur senza condividerla, non traccio dunque un profilo biografico dell'Estinto, ma mi limito a fornire la lista completa dei suoi articoli scientifici a stampa, che, in quanto tali, sono già di pubblico dominio, integrandola con l'elenco delle entità nuove descritte in detti lavori.

Per completezza desidero comunicare con animo grato che il Sig. Tortello ha deciso di donare la collezione entomologica Franciscolo al Museo Civico di Storia Naturale "Giacomo Doria" di Genova, che ha poi acquisito anche la relativa biblioteca scientifica.

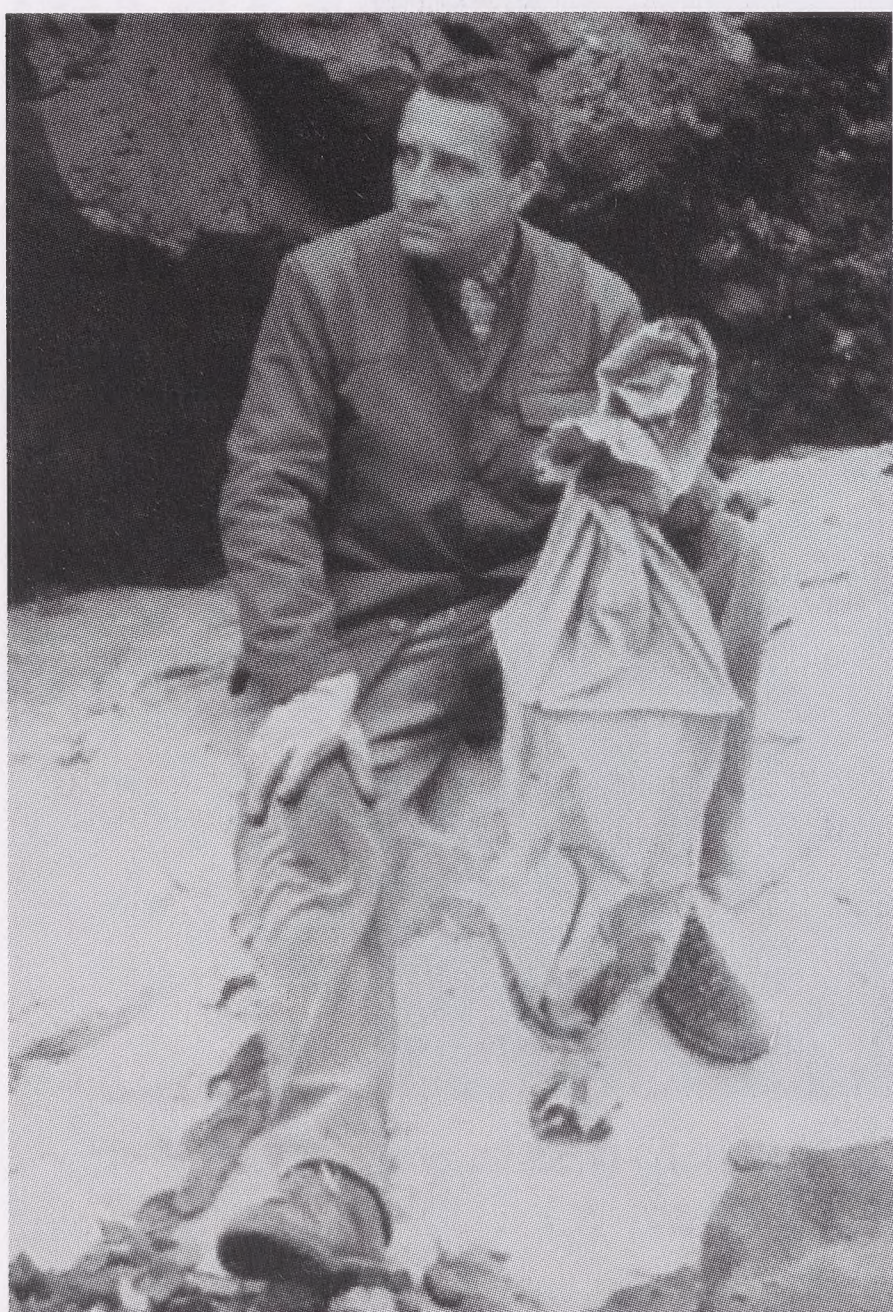


Fig. 2. Mario Franciscolo in Sardegna, a Cala Gonone, il 23.V.1980 (foto R. Poggi).



Fig. 3. Mario Franciscolo a Genova, nella biblioteca della Società Entomologica Italiana, il 24.II.2001 (foto G. Tognon).



## ELENCO DELLE PUBBLICAZIONI

L'elenco è stato compilato sulla base di una lista sommaria redatta dallo stesso Autore, cui però si sono dovute apportare varie modifiche e aggiunte; tutti i dati sono stati quindi controllati sui testi originali.

Le diciture in corpo ridotto si riferiscono a note poste dall'Autore a pie' pagina degli articoli stampati. Le mie integrazioni sono comprese tra parentesi quadre.

## 1941

- 1 - Una nuova varietà di *Mordellistena humeralis* L. Note sui Mordellini italiani (Col. Heteromera) I. [= I Contributo alla conoscenza dei Mordellidae]. Bollettino della Società entomologica italiana, 73 (8): 127-128.

## 1942

- 2 - Mordellidi raccolti dal Marchese G. Doria all'Isola del Giglio negli anni 1900 - 1902. Materiali per una Fauna dell'Arcipelago Toscano XXI. [Note sui Mordellidi italiani] II [= II Contributo alla conoscenza dei Mordellidae]. Bollettino della Società entomologica italiana, 74 (1): 6-10, 5 figg.
- 3 - Raccolte entomologiche nell'Isola di Capraia fatte da C. Mancini e da F. Capra (1927-1931). VII. Mordellidae (Col. Heteromera). (Con catalogo dei Mordellidi delle Isole dell'Arcipelago Toscano) [= III Contributo alla conoscenza dei Mordellidae]. Bollettino della Società entomologica italiana, 74 (2-3): 18-23, 5 figg.
- 4 - Una nuova specie di *Conalia* Muls. (Col. Mordellidae) [= IV Contributo alla conoscenza dei Mordellidae]. Annali del Museo civico di Storia naturale G. Doria, 61: 265-266, 3 figg.
- 5 - Diagnosi di nuovi Mordellidi italiani (Col. Heteromera). [Note sui Mordellidi italiani] III [= V Contributo alla conoscenza dei Mordellidae]. Bollettino della Società entomologica italiana, 74 (6): 76-80.
- 6 - *Mordellokoiles grandii* nuovo sottogenere e nuova specie di *Mordellistena* dell'Italia meridionale. VI° contributo alla conoscenza dei Mordellidae (Coleoptera Heteromera). Bollettino dell'Istituto di Entomologia della R. Università degli Studi di Bologna, 13 (1941): 133-136.
- 7 - Una nuova specie di *Agabus* Leach. I° Contributo alla conoscenza dei Dythiscidae [sic!] italiani. Bollettino della Società entomologica italiana, 74 (10): 137-140.

## 1943

- 8 - Nuovi generi e nuove specie di Mordellidi delle collezioni del Museo Civico di Storia Naturale di Genova [= VII Contributo alla conoscenza dei Mordellidae]. Annali del Museo civico di Storia naturale G. Doria, 61: 290-301, 3 gr. di figg.
- 9 - *Machairophora*, nuovo genere della tribù dei Mordellini ed alcune note sistematiche e sinonimiche sui Mordellidae (Col. Heteromera) [= VIII Contributo alla conoscenza dei Mordellidae]. Bollettino della Società entomologica italiana, 75 (4): 33-40, 7 figg.
- 10 - Su due nuove *Anaspis* Geoffroy (IX Contributo alla conoscenza dei Mordellidae) (Col. Heteromera). Bollettino della Società entomologica italiana, 75 (6): 76-80, 2 gr. di figg.



- 11 - Nuove specie di Mordellidae delle collezioni del Museo Civico di Storia Naturale di Genova. Nota II (XI Contributo alla conoscenza dei Mordellidae). Bollettino della Società entomologica italiana, 75 (7-8): 86-90, 19 figg.

## 1948

- 12 - Nota preliminare sulla larva della *Parabathyscia tigullina* Binaghi e notizie sulla Tana delle Streghe presso Rapallo. Bollettino della Società entomologica italiana, 78 (7-10): 51-54, 3 figg.

## 1949

- 13 - Note su alcuni Mordellidi (XII Contributo alla conoscenza dei Mordellidi) (Coleoptera: Heteromera). Bollettino della Società entomologica italiana, 79 (5-6): 52-58, 18 figg.  
 14 - La Grotta del Capo di Varigotti. Nota illustrativa preliminare. Notiziario C.A.I., Sezione ligure, Genova, (3): 7-8, 1 fig.  
 15 - XIII° Contributo alla conoscenza dei Mordellidi (Coleoptera: Heteromera). Memorie della Società entomologica italiana, 28: 81-95, 103 figg.  
 16 - Un nuovo Mordellino di Birmania (15. Contributo alla conoscenza dei Mordellidae). Doriana, 1, n. 1: 1-4, 24 figg.  
 17 - Su alcune Grotte dei dintorni di Bardineto (Provincia di Savona). Rassegna speleologica italiana, 1 (2-3): 43-52, 2 gr. di figg.

## 1950

- 18 - La Fauna della Tann-a do Balou, N° 11 LI e descrizione della larva di *Bathysciola pumilio* Reitt. (Res Ligusticae LXXXI). Annali del Museo civico di Storia naturale G. Doria, 64: 111-129, 9 figg., 2 tabb.  
 19 - Diagnosi preliminari di nuovi Mordellidi (14. Contributo alla conoscenza dei Mordellidae) (Coleoptera - Heteromera). Annali del Museo civico di Storia naturale G. Doria, 64: 130.  
 20 - 17° contributo alla conoscenza dei Mordellidae (Col. Heteromera). Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale di Milano, 89 (1-2): 17-20, 2 figg.  
 21 - Su due nuove grotte dei calcari eocenici cristallini di Liguria. Notiziario C.A.I., Sezione ligure, Genova, (2): 14-15 e (3): 14-15, 1 fig. (in coll. con Paolo Onofrio TIRAGALLO).  
 22 - *Ermischiella papuana* n. gen. n. sp. di Mordellide della Nuova Guinea e diagnosi preliminari di tre nuovi generi africani (16 Contributo alla conoscenza dei Mordellidae). Doriana, 1, n. 5: 1-8, 11 figg.

## 1951

- 23 - Recensione di: Nino SANFILIPPO - Le Grotte della Provincia di Genova e la loro Fauna. - Memoria No. 2 del Comitato Scientifico del Club Alpino Italiano, a cura del Comitato Scientifico della Sezione Ligure. Genova, 1950, F.lli Pagano Editori, pp. 1-93, 2 figg., 2 Tavole. Natura, 42 (1-2): 76-77.  
 24 - Una nuova *Mordella* dell'Albania (XVIII° Contributo alla conoscenza dei Mordel-



- lidae) (Col. - Heteromera). Bollettino della Società entomologica italiana, 81 (1-2): 7-9, 11 figg.
- 25 - Una nuova specie di *Yakuhananomia* Kono 1935 (19° Contributo alla conoscenza dei Mordellidae). Doriana, 1, n. 15: 1-6, 18 figg.
- 26 - Monografia del genere *Pselaphostena* mihi (23° Contributo alla conoscenza dei Mordellidae) (Col. Heteromera). Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale di Milano, 90 (1): 55-76, 33 figg., 1 cartina.
- 27 - La Fauna della "Arma Pollera" No. 24 LI, presso Finale Ligure. Rassegna speleologica italiana, 3 (2): 40-53, 1 tab.

## 1952

- 28 - Sulla posizione sistematica delle *Glipa* americane ed africane (20. Contributo alla conoscenza dei Mordellidae) (Coleoptera - Heteromera). Doriana, 1, n. 23: 1-8, 6 figg.
- 29 - Le *Neoglipa* e generi vicini della Nuova Guinea (25° Contributo alla conoscenza dei Mordellidae) (Coleoptera - Heteromera). Annali del Museo civico di Storia naturale G. Doria, 65: 325-357, 4 gr. di figg.
- 30 - Twenty-first contribution to the knowledge of Mordellidae (Col. Heteromera). Occasional Papers of the National Museum of Southern Rhodesia, 2 (17): 453-459, 2 gr. di figg.
- 31 - Su alcune grotte nuove o poco note della Provincia di Savona (Liguria Occident.). Rassegna speleologica italiana, 4 (2): 57-70, 2 tavv.
- 32 - On the systematic position of the genus *Ctenidia* Castelnau, 1840 (Coleoptera) (Contribution XXXIV [*recte*: XXIV] to the knowledge of the Mordellidae). Proceedings of the Royal Entomological Society of London, Series B, 21 (11-12): 155-163, 51 figg.
- 33 - 26° Contributo alla conoscenza dei Mordellidae (Coleoptera - Heteromera). Bollettino della Società entomologica italiana, 82 (7-8): 66-72, 18 figg.

## 1953

- 34 - Studio sul genere *Neocurtimorda* m. XXVII Contributo alla conoscenza dei Mordellidae (Col. Heteromera). Memorie della Società entomologica italiana, 31 (1952): 109-131, 1 cartina, 73 figg.
- 35 - Results of the Armstrong College Expedition to Siwa Oasis (Libyan Desert), 1935, under the leadership of Prof. J. Omer-Cooper. *Anaspella antennata* n. sp. (Coleoptera: Mordellidae) (22<sup>nd</sup> Contribution to the study of the Mordellidae). Bulletin de la Société Fouad I<sup>er</sup> d'Entomologie, 37: 251-253, 3 figg.

## 1954

- 36 - On two species of Anaspidinae (Coleoptera: Scraptiidae) taken on flowers of *Protea abyssinica* in Natal (XXVIII Contribution to the knowledge of Mordellidae and Scraptiidae). Proceedings of the Royal Entomological Society of London, Series B, 23 (3-4): 63-73, 5 gr. di figg.



## 1955

- 37 - Fauna cavernicola del Savonese (Res Ligusticae XCIV). Annali del Museo civico di Storia naturale G. Doria, 67: 1-223, 6 figg., 2 tabb.
- 38 - Mordellidae and Scraptiidae in the Collections of the Durban Museum (XXIX. Contribution to the Knowledge of Mordellidae and Scraptiidae). Part I. Durban Museum Novitates, 4 (12): 161-185, 11 gr. di figg.
- 39 - Les Mordellides de l'Institut Français d'Afrique Noire (XXXII<sup>e</sup> Contribution à l'étude des Mordellidae et des Scraptiidae). Bulletin de l'Institut Français d'Afrique Noire. Série A: Sciences naturelles, 17 (4): 1051-1081, 3 gr. di figg.
- 40 - Su una nuova specie del genere *Akentra* Francisc. (XXXIV<sup>o</sup> Contributo alla conoscenza degli Scraptiidae). Bollettino della Società entomologica italiana, 85 (7-8): 120-123, 9 figg.
- 41 - Recensione di: Henry BERTRAND - Les Insectes Aquatiques d'Europe (Genres: Larves, Nymphes, Imagos). - Enciclopedia [sic!] Entomologique - XXX- 2 Voll. di rispettive pagg. 556 (figg. 530) e 547 (figg. 455) - Paul Lechevalier Ed., Paris, 1954 - Prezzo 16.000 frs. Bollettino della Società entomologica italiana, 85 (7-8): 125-126.
- 42 - On two new genera of Mordellidae (Coleoptera) (Contribution No. 31 to the knowledge of Mordellidae and Scraptiidae). Proceedings of the Royal Entomological Society of London, Series B, 24 (9-10): 179-187, 5 gr. di figg.

## 1956

- 43 - Su un nuovo genere di Scraptiidae dell'India Settentr. (XXV<sup>o</sup> [recte: XXXV<sup>o</sup>] Contributo alla conoscenza degli Scraptiidae Col. Heteromera). Memorie della Società entomologica italiana, 35: 43-70, 12 gr. di figg.
- 44 - Ancora sulla posizione sistematica delle *Glipa* americane (XXXVIII<sup>o</sup> Contr. alla Conoscenza dei Mordellidae). Bollettino della Società entomologica italiana, 86 (1-2): 22-23, 3 figg.
- 45 - Su due interessanti specie del genere *Anaspis* L. del Bacino del Mediterraneo (Col. Scraptiidae) (XXXVI<sup>o</sup> Contributo alla Conoscenza degli Scraptiidae). Bollettino della Società entomologica italiana, 86 (3-4): 47-56, 5 gr. di figg.
- 46 - Voci: Karaman, Barajon, Brinck e Gridelli, pp. 62-64. In: Capra F. (a cura di). Rassegna delle pubblicazioni entomologiche riguardanti la fauna italiana. N. 17. Bollettino della Società entomologica italiana, 86 (3-4).
- 47 - *Rhabdocnemis*, nuovo genere di Scraptiidae (Col.: Heteromera) (XXXIX<sup>o</sup> Contributo alla conoscenza degli Scraptiidae). Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale di Milano, 95 (2): 129-134, 2 gr. di figg.
- 48 - Sulla presenza in Italia di *Agabus* (*Gaurodytes*) *melanocornis* Zimm. 1915 (Col. Dytiscidae - Note sui Dytiscidae italiani - II). Bollettino della Società entomologica italiana, 86 (7-8): 120-121, 6 figg.
- 49 - Ricerche zoologiche sul massiccio del Pollino (Lucania - Calabria). XVIII. Coleoptera. - 8. Mordellidae, Scraptiidae. Annuario dell'Istituto e Museo di Zoologia dell'Università di Napoli, 8 (1): 1-7.
- 50 - Studio comparativo sulle larve mature delle specie liguri cavernicole del genere *Parabathyscia* Jeann. Premier Congrès International de Spéléologie, Paris, 1953,



Communic., Tome III, Sect. 3: 95-112, 46 figg.

- 51 - Ricerche zoologiche sui Monti Sibillini (Appennino umbro-marchigiano). IX. Coleoptera: 1 - Haliplidae, Dytiscidae, Gyrinidae (Note sugli Idrocantaridi Italiani - IV). Memorie del Museo civico di Storia naturale di Verona, 5: 195-201.
- 52 - Mordellidae and Scraptiidae in the Collections of the Durban Museum (XXIX. Contribution to the Knowledge of Mordellidae and Scraptiidae). Part II. Durban Museum Novitates, 4 (14): 215-243, 6 gr. di figg.

#### 1957

- 53 - No. 30. Coleoptera: Scraptiidae and Mordellidae (XXX. Contribution to the Knowledge of Mordellidae and Scraptiidae), pp. 451-469, 7 gr. di figg. In: British Museum (Natural History), Expedition to South-West Arabia 1937-8. Volume I. Trustees of the British Museum, London.
- 54 - Sul rinvenimento di *Hydroporus incognitus* Sharp e di altre specie di Dytiscidae a geonemia boreale nelle macchie costiere toscane (Note sui Dytiscidae italiani III). Bollettino della Società entomologica italiana, 87 (1-2): 32-35, 3 figg.
- 55 - Voci: Chappuis e Rochaix, pp. 37-40. In: Capra F. (a cura di). Rassegna delle pubblicazioni entomologiche riguardanti la fauna italiana. N. 20. Bollettino della Società entomologica italiana, 87 (1-2).
- 56 - Cattura di quattro specie di Dytiscidae interessanti per la fauna italiana (Note sui Dytiscidae italiani - V). Memorie della Società entomologica italiana, 36: 45-52, 5 gr. di figg.
- 57 - Coleoptera: Mordellidae. A monograph of the South African Genera and Species. 1. Morphology, subfamily Ctenidiinae and tribe Stenaliini. South African Animal Life, Results of the Lund University Expedition in 1950-1951, Uppsala, 4 (V): 207-291, gr. di figg. 1-26.
- 58 - Voce: Ermisch, p. 134. In: Capra F. (a cura di). Rassegna delle pubblicazioni entomologiche riguardanti la fauna italiana. N. 23. Bollettino della Società entomologica italiana, 87 (7-8).

#### 1958

- 59 - Mordellidae and Scraptiidae in the Collections of the Durban Museum (XXIX. Contribution to the Knowledge of Mordellidae and Scraptiidae). Part III. Durban Museum Novitates, 5 (6): 71-94, 6 gr. di figg.

#### 1959

- 60 - British Museum Ruwenzori Expedition, 1952, Vol. II: n. 4. Coleoptera Mordellidae and Scraptiidae (30<sup>th</sup> [*recte*: 33<sup>rd</sup>] Contribution to the Knowledge of Mordellidae and Scraptiidae). British Museum (Nat. Hist.), London: 23-30, 2 figg.

#### 1961

- 61 - On a remarkable Mordellid beetle from Northern Rhodesia (Contribution No. 40 to the knowledge of Mordellidae). Proceedings of the Royal Entomological Society of London, Series B, 30 (1-2): 15-18, 11 figg.



- 62 - On four little known species of *Stenalia* Mulsant from East and South Africa (Coleoptera: Mordellidae) (Contribution No. 41 to the knowledge of Mordellidae). Proceedings of the Royal Entomological Society of London, Series B, 30 (3-4): 38-42, 19 figg.
- 63 - On a new Scraptiid beetle from Afghanistan (Contribution Nr. 44 to the knowledge of Scraptiidae, Col. Heteromera) (Contribution à l'étude de la faune d'Afghanistan, 43, Voyages du Dr. K. Lindberg 1957-59). Opuscula Entomologica, 26 (1-2): 53-57, 15 figg.
- 64 - Haliplidae, Dytiscidae, Gyrinidae dei Monti Picentini e dell'Aspromonte (Note sugli Idrocantaridi Italiani - V [*recte*: VI]) (Ricerche sulla Fauna appenninica. LX). Memorie del Museo civico di Storia naturale di Verona, 9: 155-171, 2 gr. di figg., 1 tab.

## 1962

- 65 - On some Mordellidae and Scraptiidae from Angola (Coleoptera: Heteromera) (Contribution No. 43 to the knowledge of Mordellidae and Scraptiidae). Museu do Dundo, Subsídios para o Estudo da Biologia na Lunda. Publicações culturais - Companhia de Diamantes de Angola, 56: 95-128, 16 gr. di figg.
- 66 - The genus *Glipodes* Leconte, 1862 (Coleoptera: Mordellidae), with description of a new species from Venezuela and Costa Rica (Contribution No. 42 to the knowledge of Mordellidae (Col.: Heteromera)). Proceedings of the Royal Entomological Society of London, Series B, 31 (9-10): 131-136, 20 figg.
- 67 - Note su un raro oniscino cavernicolo di Liguria (*Porcellio tortonesei* Arc. 1931) (Isopoda - Oniscidae - Oniscinae) (Res Ligusticae CXXVIII). Doriana, 3, n. 124: 1-7, 2 figg.

## 1964

- 68 - Comment to E. F. Greenmans' article on "The Upper Palaeolithic and the New World". Current Anthropology, 5 (4): 322-323.
- 69 - Nota preliminare sulla filogenia degli Scraptiidae (Coleoptera Heteromera) (44° [*recte*: 45°] Contributo alla conoscenza degli Scraptiidae). Atti V Congresso Nazionale Italiano di Entomologia (Milano, 5-8 settembre 1963). Atti dell'Accademia Nazionale Italiana di Entomologia, Rendiconti, Bologna, 11 (1963): 175-181, 2 figg.
- 70 - Haliplidae, Dytiscidae, Gyrinidae della Sila e dei Monti siculi (Note sugli Idrocantaridi italiani, VII) (Ricerche sulla Fauna appenninica LXXIX). Memorie del Museo civico di Storia naturale di Verona, 12: 173-219, 89 figg., 2 cartine, 2 tabb.

## 1965

- 71 - Coleoptera: Mordellidae. A monograph of the South African Genera and Species. 2. Tribe Mordellini. South African Animal Life, Results of the Lund University Expedition in 1950-1951, Lund, 11 (IV): 344-468, gr. di figg. 27-55.

## 1966

- 72 - Notes on Iberian Dytiscoidea, I: Methlinae Guignot, 1936, a subfamily of Dytiscidae (Coleoptera) apparently new to Europe (Contribution No. 8 to the knowledge of Dytiscoidea). Proceedings of the Royal Entomological Society of London, Series B, 35 (1-2): 11-15, 26 figg.



## 1967

- 73 - Coleoptera: Mordellidae. A monograph of the South African Genera and Species. 3. Tribe Mordellistenini. South African Animal Life, Results of the Lund University Expedition in 1950-1951, Lund, 13 (VI): 67-203, gr. di figg. 56-90, 1 tab.

## 1968

- 74 - On a new species of *Hydaticus* subgen. *Guignotites* Brinck 1943 from Portugal, with notes on palaearctic species. Notes on Iberian Dytiscoidea, II (Contribution No. 9 to the Knowledge of Dytiscoidea). Journal of natural History, 2 (1): 47-71, 142 figg.

## 1970

- 75 - *Agabus* (*Gaurodytes*) *neglectus* Er., 1887 [*sic* !] in Italia (Coleoptera Dytiscidae) (10° Contributo alla conoscenza degli Idrocantaridi). Bollettino della Società entomologica italiana, 102 (3-4): 69-75, 3 gr. di figg.

## 1972

- 76 - Hydroadephaga of Yugoslav Adriatic Islands. Part I (11<sup>th</sup> Contribution to the knowledge of Hydroadephaga). Acta entomologica jugoslavica, 8 (1-2): 55-90, 153 figg., 3 tabb.
- 77 - Su alcuni generi poco noti di Anaspidinae (47° Contributo alla conoscenza degli Scraptiidae). Memorie della Società entomologica italiana, 51: 123-155, 130 + 7 [68a-71a] figg.

## 1974

- 78 - New and little-known *Mordellistena* Costa from Pakistan and India (Coleoptera: Mordellidae) (48<sup>th</sup> contribution to the knowledge of Mordellidae). Oriental Insects, 8 (1): 71-84, 48 figg.
- 79 - Dytiscidae e Gyrinidae raccolti al Parco Nazionale La Comoé (Costa d'Avorio) dal Prof. M. Pavan (XIII Contributo alla conoscenza degli Idrocantaridi - Coleoptera). Bollettino della Società entomologica italiana, 106 (8-10): 166-170, 19 figg.

## 1975

- 80 - "Dytiscidae" raccolti a Montecristo dal Prof. M. Pavan (12° Contributo alla conoscenza dei Coleotteri Idrocantaridi). Atti del Museo civico di Storia naturale di Trieste, 29 (1): 7-13, 21 figg.
- 81 - Idrocantaridi di alcune località delle Alpi Occidentali (XIV Contr. alla conosc. degli Idrocantaridi. Coleoptera). Bollettino del Museo civico di Storia naturale di Verona, 1 (1974): 345-357, 9 tabb.
- 82 - Sulla posizione sistematica di *Thylocladius contractus* Motschulsky 1839 (Coleoptera Bostrychiformia). Atti X Congresso nazionale italiano di Entomologia, Sassari, 20-25 maggio 1974, Tip. Coppini, Firenze: 235-237.
- 83 - Sulla posizione sistematica di *Thylocladius contractus* Motschulsky 1839 (Coleoptera, Series Bostrychiformia). Bollettino della Società entomologica italiana, 107 (6-8): 142-146, 7 figg.



## 1976

- 84 - "Coleoptera Hydradeephaga e Hydrophiloidea" del Lago di Doberdò presso Gorizia. Atti del Museo civico di Storia naturale di Trieste, 29 (2) (N. 8): 123-162, 54 figg., 1 tab. (in collaborazione con Patrizia MALARODA).

## 1978

- 85 - Su alcuni Gyrinidae abissini (Coleoptera) (16° contributo alla conoscenza degli Idrocantari). Quaderni dell'Accademia nazionale dei Lincei, 243 (Zoological Researches in Ethiopia. Part I): 125-130, 8 figg.
- 86 - Hydradeephaga of Yugoslav Adriatic Islands - Part II Cres, Lošinj and Unije (17<sup>th</sup> Contrib. to the knowl. of Hydradeephaga - Col.). Acta entomologica jugoslavica, 14 (1-2): 35-47, 7 figg., 3 tabb.
- 87 - Su alcuni Coleotteri Idradeefagi di Iugoslavia (18° Contributo alla conoscenza degli Idradeefagi). Bollettino della Società entomologica italiana, 110 (9): 171-177, 23 figg.

## 1979

- 88 - Fauna d'Italia, XIV. Coleoptera Haliplidae, Hygrobiidae, Gyrinidae, Dytiscidae. Ed. Calderini, Bologna, I-VI + 804 pp., 2.235 figg.
- 89 - On a new Dytiscidae from a Mexican cave. A preliminary description (Coleoptera) (19<sup>th</sup> contrib. to the knowledge of Hydradeephaga). Fragmenta entomologica, 15 (1): 233-241, 7 figg.
- 90 - Drugi prilog poznavanju Dytiscida (Coleoptera) Jugoslavije. Acta entomologica jugoslavica, 15 (1-2): 133-137, 12 figg.

## 1980

- 91 - Adaptation in hypogean Hydradeephaga. XVI International Congress of Entomology, Kyoto, Abstracts, Section 1R-3, 7: 16.
- 92 - Revision of *Zeamordella* Broun 1886 and *Stenomordellaria* Ermisch 1950 (Col. Mordellidae) (49<sup>th</sup> contribution to the knowledge of Mordellidae). Annali del Museo civico di Storia naturale G. Doria, 83: 191-222, 64 figg.

## 1982

- 93 - Some new records of Gyrinidae (Coleoptera) from Sierra Leone (23<sup>rd</sup> Contribution to the knowledge of Hydradeephaga). Quaderni dell'Accademia nazionale dei Lincei, 255 (Ricerche Biologiche in Sierra Leone): 63-81, 82 figg., 1 tab.
- 94 - Una insolita cattura di *Atractocerus brevicornis* (L.) in Italia (Col. Lymexylonidae) (Res Ligusticae CCX). Doriana, 5, n. 248: 1-4.
- 95 - Recensione di: ZUNINO M. - Origine ed evoluzione degli insetti - Quaderni scientifici Loescher, diretti da Franco Ricca - N°6 - Loescher Editore, Torino 1981 - 67 pp., 43 figg., brochure, Lire 3.200 e di: Proceedings of the International Symposium on Trichoptera - University of Perugia (Italy), 28 July - 2 August 1980 - Edited by Giampaolo Moretti - Dr. W. Junk Publishers - Series Entomologica - 20 The Hague - 1981: I-XXI + 1-472, figg. Bollettino della Società entomologica italiana, 114 (4-7): 122-123.



- 96 - Mordellidae (Coleoptera Heteromera) from Rennell and Bellona Islands (Solomons) (50<sup>th</sup> contribution to the knowledge of Mordellidae), pp. 49-72, 96 figg. In: T. Wolff (ed.). The Natural History of Rennell Island, British Solomon Islands, Copenhagen, 8.
- 97 - Le *Anaspis* (s. str.) del gruppo *maculata* Fourcr., con descrizione di una nuova specie sarda (53° [*recte*: 51°] Contributo alla conoscenza degli Scraptiidae - Coleoptera). Memorie della Società entomologica italiana, 60 (1981): 197-207, 3 tavv.

## 1983

- 98 - Recensione di: WIGGLESWORTH V. B., F.R.S. - The principles of insect physiology - 7<sup>th</sup> ed. - Science Paperbacks - Chapman & Hall, London, New York - 827 pp., 407 figg. - 15 sterline. Bollettino della Società entomologica italiana, 115 (1-3): 50.
- 99 - Adaptation in hypogean Hydradephaga, with new notes on *Sanfilippodytes* (Col. Dytiscidae & Phreatodytidae) (21<sup>st</sup> contribution to the knowledge of Hydradephaga). Special Issue Aquatic Coleoptera Work. XVI International Congress of Entomology, Kyoto, Ed. M. Satô: 5-20, 34 figg.
- 100 - Perché la Sardegna non ha endemiti tra i Coleotteri Adefagi acquaioli? (22° contributo alla conoscenza degli Idradefagi). Lavori della Società italiana di Biogeografia, N. S., 8 (1980): 641-660, 8 figg.

## 1984

- 101 - About a new fungus-eating Mordellid-beetle from Ecuador (Col. Mordellidae) (52<sup>nd</sup> contribution to the knowledge of Mordellidae). Annali del Museo civico di Storia naturale G. Doria, 85: 79-93, 34 figg., 1 tav.
- 102 - The geographical boundary of the eastern and western hydradephagan fauna in Yugoslavia (Coleoptera) (24<sup>th</sup> contribution to the knowledge of Hydradephaga). Verhandlungen des Zehnten Internationalen Symposiums über Entomofaunistik Mitteleuropas (SIEEC), 15.-20. August 1983, Budapest. Herausgegeben von Z. Kaszab, Budapest, 1984: 257-259 (un riassunto del contributo è pubblicato a pag. 18 nel volume degli Abstracts: Auszüge der Vorträge des X. Internationalen Symposium für die Entomofaunistik Mitteleuropas. Budapest 1983 / Abstracts of Lectures given at the tenth International Symposium on Entomofaunistics, Central Europe. Budapest 1983).
- 103 - Project Wallace 1985. Bollettino della Società entomologica italiana, 116 (4-7): 71-72.
- 104 - Recensione di: FIORI G., BIN F. & SENSIDONI A., 1983 - Atlante entomologico, Morfologia esterna - Galeno Editrice, Perugia - pp. I-IV + 115 tavole. L. 25.000 in brochure. Bollettino della Società entomologica italiana, 116 (4-7): 125.

## 1985

- 105 - The Passaliden-Club. Antenna, London, 9 (1): 26 (in collaborazione con Nigel D. M. FERGUSON).
- 106 - Lymexyloidea, pp. 240-243, figs 20.171-20.181. In: C. H. Scholtz & E. Holm (eds.). Insects of Southern Africa Ed. Butterworths, Durban, 502 pp., 12 tavv. col. e numerose figg.



- 107 - Recensione di: BERIO E., 1985 - Lepidoptera Noctuidae. I. Generalità Hadeninae Cuccullinae [*sic* !] - Fauna d'Italia XXII, Edizioni Calderini, Bologna - XXIII+970 pp., 322 figg. n.t. e 32 tavv. a colori. Natura, 76 (1-4): 121-122.

## 1986

- 108 - Ricerche zoologiche della "Reef '78" alle Andamane. X. Coleoptera - Lucanidae. Bollettino del Museo civico di Storia naturale di Verona, 11 (1984): 339-344, 9 figg.
- 109 - Ricerche nell'Asia sudorientale. XIV. Coleoptera - Lucanidae. Bollettino del Museo civico di Storia naturale di Verona, 11 (1984): 505-513, 12 figg.
- 110 - Recensione di: PERKINS John H., 1982 - Insects, Experts and the Insecticide Crisis. The quest for new pest management strategies - Plenum Press, New York & London - pp. I-XVIII + 1-304, 15 figure (♂ 29,50); HOLLIS D., 1980 - Animal identification - A reference guide - Vol. 3 - Insects - British Museum (N.H.) London, John Wiley & Sons, Chichester, New York, Brisbane, Toronto ed. - pp. I-VII + 1-160. (L.St. 17,30); EISENBEIS G. & WICHARD W., 1985 - Atlas zur Biologie der Boden-Arthropoden - Gustav Fischer Verlag, Stuttgart, New York - I-VII + 1-434, 192 tavv. (con circa 1100 figg.) e 219 figg. n.t. (D.M. 118.-). Bollettino della Società entomologica italiana, 118 (1-3): 53; 54; 54.
- 111 - Gyrinidae and Dytiscidae collected in Sierra Leone (1982, 1983, 1984) by Dr. W. Rossi (Col. Hydradephaga) (25<sup>th</sup> Contribution to the knowledge of Hydradephaga). Quaderni dell'Accademia nazionale dei Lincei, 260 (Ricerche Biologiche in Sierra Leone. Parte II): 11-36, 92 figg., 1 tab., 1 tav. (in collaborazione con Nino SANFILIPPO).
- 112 - Revision of *Cothurus* Champion 1891 (Col. Mordellidae) (53<sup>rd</sup> contribution to the knowledge of Mordellidae). Annali del Museo civico di Storia naturale G. Doria, 86: 225-233, 31 figg.
- 113 - On some Gyrinidae (Col.) from Congo People's Republic (26<sup>th</sup> contribution to the study of Hydradephaga). Annali del Museo civico di Storia naturale G. Doria, 86: 251-264, 46 figg.
- 114 - Lineamenti faunistici della valle del Verde e dell'altopiano di Praglia, pp. 98-120, 7 figg. In: M. Firpo & A. Galli (coordinatori). Studi e Ricerche, cultura del territorio. Comune di Campomorone, 3.

## 1988

- 115 - New *Africophilus* Guignot collected by Prof. Walter Rossi in the 1986 - 1987 expeditions to Sierra Leone sponsored by Accademia Nazionale dei Lincei (Coleoptera Dytiscidae) (26<sup>th</sup> [*recte*: 26<sup>th</sup> bis] contribution to the knowledge of Hydradephaga). Bollettino della Società entomologica italiana, 120 (2): 84-100, 55 figg. (in collaborazione con Nino SANFILIPPO).
- 116 - Materiali per una fauna dell'Arcipelago toscano. XXVIII. Scraptiidae (Col. Heter.) di Montecristo (54° contributo alla conoscenza degli Scraptiidae). Doriana, 6, n. 263: 1-5, 6 figg.

## 1989

- 117 - About the genus *Parastenomordella* Ermisch 1950 (Coleoptera: Mordellidae) (57<sup>th</sup>



contribution to the knowledge of Mordellidae). Annali del Museo civico di Storia naturale G. Doria, 87: 297-309, 23 figg.

- 118 - About *Ectasiocnemis* Franciscolo, 1956 (Coleoptera Scraptiidae) (56th contribution to the knowledge of Scraptidae [sic !]). Bollettino della Società entomologica italiana, 121 (2): 108-123, 23 figg., 1 tab.
- 119 - About the position of *Anaspis* (s. str.) *graeca* Schilsky 1895 (Coleoptera, Scraptiidae) (55th contribution to the knowledge of Scraptiidae). Elytron, 3: 9-14, 33 figg.

#### 1990

- 120 - A new species of *Glipodes* Leconte 1862 from Venezuela, the fourth in the genus (Coleoptera: Mordellidae: Conaliini) (58th contribution to the knowledge of Mordellidae). The Coleopterists Bulletin, 44 (1): 105-111, 17 figg.
- 121 - Recensione di: P. CAVAZZUTI - Monografia del genere *Procerus* - Associazione Naturalistica Piemontese - Memorie, I, 1989: I-XI + 200, 134 figg. Edizioni l'Artistica, Savigliano - L. 160.000; M. ZUNINO & G. HALFFTER, 1988 - Análisis taxonómico, ecológico y bio[geo]gráfico de un grupo americano de *Onthophagus* (Coleoptera - Scarabaeidae) - Monografia IX - Museo Regionale di Scienze Naturali, Torino: 211 pp., 116 figg., 8 carte, 2 tavv. a colori - L. 35.000. Bollettino della Società entomologica italiana, 122 (2): 158-159; 159-160.
- 122 - Recensione di: CAVAZZUTI, P. 1989. Monografia del genere *Procerus*. Associazione Naturalistica Piemontese. Memorie, I: I-XI+200, 134 figs. Edizioni l'Artistica, Savigliano. L. it. 160.000. Elytron, 4: 212.
- 123 - Four new species and new records of Hydradeephaga from Sierra Leone (Coleoptera: Haliplidae, Gyrinidae, Dytiscidae) (27th contribution to the knowledge of Hydradeephaga). Quaderni dell'Accademia nazionale dei Lincei, 265 (Ricerche Biologiche in Sierra Leone. Parte III): 133-153, 55 figg. (in collaborazione con Nino SANFILIPPO).
- 124 - An account on Lucanidae from Sierra Leone (Coleoptera) (3rd contribution to the knowledge of Lucanidae). Quaderni dell'Accademia nazionale dei Lincei, 265 (Ricerche Biologiche in Sierra Leone. Parte III): 191-204, 22 figg.
- 125 - On some Mordellidae (Coleoptera Heteromera) from Sierra Leone (59th contribution to the knowledge of Mordellidae and Scraptiidae). Quaderni dell'Accademia nazionale dei Lincei, 265 (Ricerche Biologiche in Sierra Leone. Parte III): 205-218, 35 figg.

#### 1991

- 126 - *Derovatellus olofi*, nomen novum pro *D. bistroemi* Franc. & Sanf. (Coleoptera Dytiscidae). Bollettino della Società entomologica italiana, 122 (3) (1990): 164 (in collaborazione con Nino SANFILIPPO).
- 127 - *Yolina tiwaiensis* Franciscolo & Sanfilippo, 1990, junior synonym of *Yolina libera* Biström, 1989 (Coleoptera, Dytiscidae). Entomologica fennica, 2 (2): 52 (in collaborazione con Olof BISTRÖM & Nino SANFILIPPO).
- 128 - Cap. III. Armi da fuoco, archi e munizioni di caccia. Con nozioni sulle norme che ne regolano l'acquisto, la detenzione, la custodia, il porto. Comportamento in caccia, pp. 161-223, 64 figg., 5 tabb., schemi vari. In: S. Spanò (a cura di). La Caccia. Regione Liguria, Servizio Produzioni Agricole e Valorizzazione dell'Agricoltura, Ge-



nova. I.E.E., Editoriale Europea, Cengio (SV), 1991 (1989), 243 pp., numerose ill.

- 129 - Su alcuni Mordellidi e Scraptiidi (Coleoptera - Heteromera) delle Isole Pelagie (60° contributo alla conoscenza dei Mordellidi e Scraptiidi). *Il Naturalista siciliano*, S. IV, 15 (3-4): 167-178, 25 + 1 figg.

#### 1992

- 130 - Mordellidae, Scraptiidae, Rhipiphoridae (Col. Heteromera) of China, today - Proceedings of XIX International Congress of Entomology, Beijing, China, June 28-July 4, 1992, Abstracts (Sect. IC-2): 34.

#### 1993

- 131 - The presence of *Zeamordella* Broun, 1886 in Wallacea (Coleoptera Mordellidae) (Project Wallace paper n. 139) (61<sup>st</sup> contrib. to the knowl. of Mordellidae and Scraptiidae). *Memorie della Società entomologica italiana*, 71 (2) (1992): 563-572, 25 figg.
- 132 - Segnalazioni faunistiche italiane. 225. *Eucinetus hopffgarteni prospector* Vit, 1985 (Coleoptera Eucinetidae). *Bollettino della Società entomologica italiana*, 125 (1): 73.
- 133 - A new *Anaspis* (*Pinassa* Ermisch, 1950) and a new subapterous genus of Anaspidinae from Kenya (Coleoptera: Scraptiidae) (65<sup>th</sup> contribution to the knowledge of Mordellidae and Scraptiidae). *Elytron*, 7: 3-19, 54 figg., 1 foto.

#### 1994

- 134 - Cladistimania. *Antenna*, 8 (4): 184-185.
- 135 - Recensione di: PAULIAN R. - Les Coléoptères a la conquête de la Terra [sic!], Société nouvelle des Éditions Boubée, Paris, 241 pp., 55 figg. e 8 tavv. a colori. *Bollettino della Società entomologica italiana*, 126 (1): 80-81.
- 136 - Three new *Africophilus* Guignot and new records of Gyrinidae and Dytiscidae from Sierra Leone (Coleoptera) (30<sup>th</sup> contribution to the knowledge of Hydradeptera). *Quaderni dell'Accademia nazionale dei Lincei*, 267 (Ricerche Biologiche in Sierra Leone. Parte IV): 267-298, 66 figg.
- 137 - More Lucanid-beetles (Coleoptera) from Sierra Leone (4<sup>th</sup> contribution to the knowledge of Lucanidae). *Quaderni dell'Accademia nazionale dei Lincei*, 267 (Ricerche Biologiche in Sierra Leone. Parte IV): 321-327, 17 figg.
- 138 - New findings of Sierra-Leonean Mordellidae (Coleoptera - Heter.) (63<sup>th</sup> contrib. to the knowl. of Mordellidae and Scraptiidae). *Quaderni dell'Accademia nazionale dei Lincei*, 267 (Ricerche Biologiche in Sierra Leone. Parte IV): 381-397, 46 figg.

#### 1995

- 139 - Mordellidae, pp.11-13; Scraptiidae, pp. 25-26 [= 66° contributo alla conoscenza dei Mordellidae e degli Scraptiidae]. In: F. Angelini, P. Audisio, M. A. Bologna, A. De Biase, M. E. Franciscolo, G. Nardi, E. Ratti & M. F. Zampetti, *Coleoptera Polyphaga XII* (Heteromera escl. Lagriidae, Alleculidae, Tenebrionidae). In: A. Minelli, S. Ruffo & A. La Posta (eds.). *Checklist delle specie della fauna italiana*, 58. Ed. Calderini, Bologna.



## 1996

- 140 - In ricordo di Antonino Sanfilippo (Genova 28.01.1922 - Carro 30.10.1994). Memorie della Società entomologica italiana, 74 (1995): 3-15, 6 figg.
- 141 - Recensione di: MINELLI A., 1993 - Biological Systematics; the state of the art - Chapman & Hall, London, pp. XVI-387, 20 figg. GBP 47 (hardback), 19,99 (paperback). Bollettino della Società entomologica italiana, 127 (3) (1995): 267-269.
- 142 - Recensione di: AA.VV., 1995 - Arthropoda di Lampedusa, Linosa e Pantelleria (Canale di Sicilia, Mar Mediterraneo) - B. Massa ed. - Il Naturalista Siciliano, Palermo - 19, Suppl., Ser. IV:I-IX + 1-909, 149 figg. L. 80.000 (L. 55.000 per i Soci della Società Siciliana di Scienze Naturali) (versamento sul c/c postale n. 15328909 intestato alla Società Siciliana di Scienze Naturali). Bollettino della Società entomologica italiana, 128 (1): 92-93.

## 1997

- 143 - Fauna d'Italia, XXXV. Coleoptera Lucanidae. Ed. Calderini, Bologna, 228 pp., 442 figg.
- 144 - *Glipa sanfilippoi* n. sp. (Coleoptera, Mordellidae), the largest species of the genus in Africa (Sierra Leone) [= 67° contributo alla conoscenza dei Mordellidae]. Miscel-lània zo-  
lògica, 20 (2): 85-92, 18 figg.

## 1998

- 145 - On "*Mordella*" *luteoguttata* Blanchard, 1843 rediscovered, with notes on *Yakuhananomia* Kôno, 1935 (Col. Mordellidae) (68<sup>th</sup> contribution to the knowl. of Mordellidae and Scraptiidae). Annali del Museo civico di Storia naturale G. Doria, 92: 231-245, 23 figg.
- 146 - Recensione di: HANSEN M. Phylogeny and classification of the staphyliniform beetle families (Coleoptera) - Biol. skr. Dan. Vid. Selsk. 48 - P.L. Hiorth ed., Copenhagen, 1997 - 339 pp., 492 figg. 600 Corone Danesi. Bollettino della Società entomologica italiana, 130 (1): 87-88.

## 1999

- 147 - About *Glipostena* with description of three new species (Coleoptera Mordellidae) (69<sup>th</sup> contribution to the knowledge of Mordellidae and Scraptiidae). Memorie della Società entomologica italiana, 77 (1998): 241-258, 61 figg.

## 2000

- 148 - A new *Glipostena* Ermisch, 1941 from Philippines and Papuasiasia (Coleoptera: Mordellidae) (70<sup>th</sup> contribution to the knowledge of Mordellidae and Scraptiidae). Elytron, 13 (1999): 101-108, 28 figg.
- 149 - A new Mordellid genus with rhipiphoroids traits (Coleoptera: Mordellidae) (72<sup>nd</sup> contribution to the knowledge of Mordellidae and Scraptiidae). The Coleopterists Bulletin, 54 (3): 395-402, 26 figg.
- 150 - An updated look at *Glipidiomorpha* (Coleoptera, Mordellidae) (70<sup>th</sup> [recte: 71<sup>st</sup>] contribution to the knowledge of Mordellidae and Scraptiidae). Annali del Museo civico di Storia naturale G. Doria, 93: 185-210, 58 figg., 1 tab.



2001

151 - A new species of *Glipidiomorpha* from Zimbabwe (Coleoptera Mordellidae) (73<sup>rd</sup> contribution to the knowledge of Mordellidae and Scraptiidae). *Bollettino della Società entomologica italiana*, 133 (3): 213-218, 23 figg.

## DATI RIASSUNTIVI

I lavori scritti in collaborazione sono solo 8 su 151 e riguardano soprattutto gli Hydradephaga; quelli relativi a Mordellidae e Scraptiidae sono tutti scritti a un solo nome.

Per quanto riguarda gli argomenti, le 151 pubblicazioni possono essere così raggruppate:

- 76: Coleoptera Mordellidae e Scraptiidae
- 32: Coleoptera Hydradephaga
- 5: Coleoptera Lucanidae
- 5: Altri Coleoptera
- 16: Recensioni e rassegne bibliografiche
- 10: Speleologia e fauna cavernicola
- 6: Varia
- 1: Necrologi

Le pubblicazioni su Mordellidae + Scraptiidae si susseguono per tutta la vita attiva dell'Autore, dal 1941 al 2001, con un massimo negli anni '50, quando escono i contributi sui materiali sudafricani inviati in studio soprattutto dai musei di Londra, Pretoria, Città del Capo, Lund e Durban, per calare un po' negli anni '70 e riprendere infine vigore negli anni '90. Sfortunatamente, la redazione del volume su Mordellidae e Scraptiidae della Fauna d'Italia è rimasta solo a livello di proposito.

Le pubblicazioni sugli Hydradephaga sono comprese tra il 1942 e il 1994, con un massimo alla fine degli anni '70, in contemporanea con la redazione del volume della Fauna d'Italia.

Le pubblicazioni di argomento biospeleologico appaiono tra il 1948 e il 1962, con l'importante contributo sulla fauna cavernicola del Savonese stampato nel 1955.

Le pubblicazioni sui Lucanidae vedono la luce solo tra il 1986 e il 1997, poiché l'interesse per tale famiglia sorge nell'Autore a partire dagli anni '80 e si conclude con la redazione del relativo volume della Fauna d'Italia.

## LE "SERIE"

Franciscolo radunò in serie, con una numerazione progressiva, i lavori relativi ai gruppi preferiti (Mordellidae + Scraptiidae, Hydradephaga e Lucanidae); purtroppo per la contemporaneità della redazione di molti articoli e i ritardi nella loro stampa le numerazioni attribuite dall'Autore non sempre rispecchiano la vera successione temporale e alcune sono doppie o incerte.

Il riferimento alla "serie" non ha una posizione costante nei lavori: a volte è nel titolo, a volte nel sottotitolo, a volte in nota a piè di pagina e in qualche caso manca del tutto; nei testi in inglese risulta poi variamente tradotto e più o meno difformemente abbreviato.



Anche le denominazioni delle “serie” hanno subito modifiche e correzioni nel corso del tempo; ad esempio la classica “.... Contributo alla conoscenza dei Mordellidae e degli Scaptiidae” è iniziata negli anni '40 come “... Contributo alla conoscenza dei Mordellidae”, quando gli attuali Scaptiidae erano ancora considerati come Scaptiinae ed Anaspidini all'interno della famiglia Mordellidae. In seguito Franciscolo adottò l'assetto sistematico proposto da Crowson ma mantenne la numerazione progressiva degli articoli, per cui li assegnò ora ai Mordellidae ora agli Scaptiidae ora ad entrambi, a seconda delle occasioni.

Anche nel caso degli Hydradephaga, la “serie” inizia come “Note sui Dytiscidae italiani...” per finire poi come “ ... Contribution to the knowledge of Hydradephaga”, cambiando oggetto ben cinque volte (prima Dytiscidae, poi Idrocantaridi, poi Dytiscoidea, poi Hydroadephaga e infine Hydradephaga), pur mantenendo la progressione numerica.

Per favorire le ricerche bibliografiche ritengo dunque utile fornire qui di seguito uno specchietto riassuntivo che comprende nella colonna di sinistra (numeri ordinali) la progressione dei contributi, in quella centrale il numero della relativa pubblicazione (con riferimento, tra parentesi, all'elenco “ufficiale” sopra compilato) e in quella di destra l'anno di reale pubblicazione del lavoro. Le parentesi quadre racchiudono attribuzioni numeriche eseguite da me, mancando negli articoli originali ogni riferimento in merito.

Serie dedicata a Mordellidae e/o Scaptiidae  
(M = Mordellidae; S = Scaptiidae; M+S = Mordellidae e Scaptiidae)

1°	(1) M	1941
2°	(2) M	1942
3°	(3) M	1942
4°	(4) M	1942
5°	(5) M	1942
6°	(6) M	1942
7°	(8) M	1943
8°	(9) M	1943
9°	(10) M	1943
10°	inesistente	
11°	(11) M	1943
12°	(13) M	1949
13°	(15) M	1949
14°	(19) M	1950
15°	(16) M	1949
16°	(22) M	1950
17°	(20) M	1950
18°	(24) M	1951
19°	(25) M	1951
20°	(28) M	1952
21°	(30) M	1952
22°	(35) M	1953



23°	(26) M	1951
24°	(32) M	1952 (pubblicato erroneamente come 34°)
25°	(29) M	1952
26°	(33) M	1952
27°	(34) M	1953
28°	(36) M+S	1954
29°	(38,52,59) M+S	1955-58
30°	(53) M+S	1957
31°	(42) M+S	1955
32°	(39) M+S	1955
33°	(60) M+S	1959 (pubblicato erroneamente come 30°)
34°	(40) S	1955
35°	(43) S	1956 (pubblicato erroneamente come 25°)
36°	(45) S	1956
[37°]	(49) M+S	1956
38°	(44) M	1956
39°	(47) S	1956
40°	(61) M	1961
41°	(62) M	1961
42°	(66) M	1962
43°	(65) M+S	1962
44°	(63) S	1961
45°	(69) S	1963 (pubblicato erroneamente come 44°)
[46°]	(57,71,73) M	1957-1965-1967
47°	(77) S	1972
48°	(78) M	1974
49°	(92) M	1980
50°	(96) M	1982
51°	(97) S	1982 (pubblicato erroneamente come 53°)
52°	(101) M	1984
53°	(112) M	1986
54°	(116) S	1988
55°	(119) S	1989
56°	(118) S	1989
57°	(117) M	1989
58°	(120) M	1990
59°	(125) M+S	1990
60°	(129) M+S	1991
61°	(131) M+S	1993
[62°]	(130) M+S	1992
63°	(138) M+S	1994
64°	inesistente	
65°	(133) M+S	1993
[66°]	(139) M+S	1995



67°	(144) M	1997
68°	(145) M	1998
69°	(147) M+S	1999
70°	(148) M+S	2000
71°	(150) M+S	2000 (pubblicato erroneamente come 70°)
72°	(149) M+S	2000
73°	(151) M+S	2001

Serie dedicata a Hydradephaga

(Prima Dytiscidae, poi Idrocantaridi, poi Dytiscoidea, poi Hydroadephaga, infine Hydradephaga)

1°	(7)	1942
2°	(48)	1956
3°	(54)	1957
4°	(51)	1956
5°	(56)	1957
6°	(64)	1961 (pubblicato erroneamente come 5°)
7°	(70)	1964
8°	(72)	1966
9°	(74)	1968
10°	(75)	1970
11°	(76)	1972
12°	(80)	1975
13°	(79)	1974
14°	(81)	1974
[15°]	(84)	1976
16°	(85)	1978
17°	(86)	1978
18°	(87)	1978
19°	(89)	1979
[20°]	(90)	1979
21°	(99)	1983
22°	(100)	1983
23°	(93)	1982
24°	(102)	1984
25°	(111)	1986
26°	(113)	1986
26° bis	(115)	1988 (pubblicato erroneamente come 26°)
27°	(123)	1990
[28°]	(126)	1991
[29°]	(127)	1991
30°	(136)	1994



## Serie dedicata a Lucanidae

[1°]	(108)	1986
[2°]	(109)	1986
3°	(124)	1990
4°	(137)	1994

## ELENCO DEI NUOVI TAXA

I nuovi taxa di Coleoptera che hanno ricevuto un nome da Franciscolo sono complessivamente 297, così suddivisi (si mantiene lo status stabilito nei lavori dell'Autore):

1 superfamiglia, 1 famiglia, 1 sottofamiglia, 5 tribù,  
32 generi, 4 sottogeneri,  
243 specie, 2 sottospecie, 4 aberrazioni, 1 varietà,  
2 nomi nuovi, 1 nome nudo

I gruppi di appartenenza sono: Mordellidae (235 taxa), Scraptiidae (40), Dytiscidae (17), Gyrinidae (2), Dermestoidea (2) e Lucanidae (1).

Per quanto riguarda l'ambito geografico delle nuove specie, sottospecie e categorie inferiori, nei Mordellidae sono descritti 204 taxa, di cui 12 provengono dall'Italia, 8 da altre nazioni d'Europa, 153 dall'Africa, 10 dall'Asia, 14 dall'Oceania e 7 dall'America centro-meridionale.

Gli Scraptiidae comprendono 28 taxa: 6 dall'Italia, 2 da altre nazioni d'Europa, 8 dall'Africa, 11 dall'Asia ed 1 dall'America centrale.

Ai Dytiscidae sono riferiti 15 taxa: 3 dall'Italia, 1 da altre nazioni d'Europa, 10 dall'Africa ed 1 dal Messico.

Le tre specie di Gyrinidae (2) e di Lucanidae (1) provengono tutte dall'Africa.

Nell'elenco che segue i taxa sono disposti in stretto ordine alfabetico.

Il numero posto fra parentesi dopo il nome di ogni nuovo taxon indica il lavoro in cui è comparsa la descrizione, secondo la numerazione progressiva dell'elenco bibliografico sopra compilato. Tra parentesi sono riportati eventuali cambiamenti di status proposti in lavori compresi nell'elenco bibliografico; inoltre sono evidenziati quei nuovi taxa (es. *Pselaphostena arnoldi*, Stenaliini) descritti in chiavi di determinazione e poi descritti "in extenso" come nuovi in lavori successivi.

Coleoptera Dytiscidae

*Africophilus cesii* Sanfilippo & Franciscolo (115): Sierra Leone

*Africophilus montalentii* Sanfilippo & Franciscolo (115): Sierra Leone

*Africophilus omercooperae* (136): Sierra Leone

*Africophilus sanfilippoi* (136): Sierra Leone

*Africophilus sinuaticauda* (136): Sierra Leone

*Africophilus walterrossii* Sanfilippo & Franciscolo (115): Sierra Leone

*Agabus* (*Gaurodytes*) *concii* (7): Italia, Trentino (= considerato poi ab. di *A. biguttatus* (Olivier, 1795) in 56 e poi un suo sinonimo in 88)



- Agabus (Gaurodytes) pseudoneglectus* (76): Italia, Emilia  
*Derovatellus* (s. str.) *bistroemi* Franciscolo & Sanfilippo (123): Sierra Leone (= denominato poi *D. olofi* Franciscolo & Sanfilippo, nomen novum pro *bistroemi* Franciscolo & Sanfilippo, 1990 nec *bistroemi* Brancucci, 1981 in 126)  
*Hydaticus (Guignotites) debarrosmachadoi* (74): Portogallo  
*Liodessus leonensis* Franciscolo & Sanfilippo (123): Sierra Leone  
*Sanfilippodytes* n. gen. (89)  
*Sanfilippodytes sbordonii* (89): Messico  
*Scarodytes savinensis* ssp. *ruffoi* (64): Italia, Campania  
*Uvarus poggii* Franciscolo & Sanfilippo (123): Sierra Leone  
*Yolina tiwaiensis* Franciscolo & Sanfilippo (123): Sierra Leone (= considerata poi sinonimo di *Y. libera* Biström, 1987 in 127)

In totale: 1 gen., 14 spp. (+ 1 nom. nov.), 1 ssp.

#### Coleoptera Gyrinidae

- Orectogyrus (Allogyrus) walterrossii* Franciscolo & Sanfilippo (111): Sierra Leone  
*Orectogyrus (Lobogyrus) spinifer* (113): Rep. Dem. Congo

In totale: 2 spp.

#### Coleoptera Mordellidae

- Aelptes* n. gen. (71)  
*Aelptes clavipalpis* (71): Mozambico  
*Anthobatula scorteccii* (11): Kenya (trasferita poi a *Pseudopentaria* in 53)  
*Binaghia* n. gen. (8)  
*Binaghia concii* (8): Is. Bioko (= Fernando Poo)  
*Binaghia humerosticta* (8): Is. Bioko (= Fernando Poo)  
*Boatia* n. gen. (101)  
*Boatia albertae* (101): Ecuador  
*Caffromorda* n. gen. (33)  
*Caffromorda platycephala* (33): Sudafrica  
*Cephaloglipa* n. gen. (29)  
*Cephaloglipa paumomuensis* (29): Nuova Guinea  
*Conalia debeauxi* (4): Sumatra (trasferita poi a *Pseudoconalia* in 66)  
*Cothurus bordoni* (112): Venezuela  
Ctenidiinae n. subfam. (26)  
*Dellamora walteriana* (125): Sierra Leone  
*Dollmania* n. gen. (61)  
*Dollmania scraptiiformis* (61): Zimbabwe  
*Dollmania trotommoides* (65): Angola  
*Ermischiella* n. gen. (22)  
*Ermischiella papuana* (22): Nuova Guinea



- Falsopseudotomoxia tertia* (71): Namibia  
*Glipa sanfilippoi* (144): Sierra Leone  
*Glipidiomorpha* n. gen. (29)  
*Glipidiomorpha astrolabii* (29): Nuova Guinea  
*Glipidiomorpha dorsalis* (38): Kenya  
*Glipidiomorpha ideodorsalis* (38): Zimbabwe  
*Glipidiomorpha intermedia* (38): Sudafrica  
*Glipidiomorpha leucozona* (29): Nuova Guinea  
*Glipidiomorpha obsoleta* (38): Zimbabwe  
*Glipidiomorpha poggii* (151): Zimbabwe  
*Glipidiomorpha rhodesiensis* (38): Zimbabwe  
*Glipidiomorpha riesei* (150): India  
*Glipidiomorpha septentrionalis* (138): Sierra Leone  
*Glipidiomorpha suturalis* (38): Uganda  
*Glipodes bordoni* (120): Venezuela  
*Glipodes dietrichi* (66): Venezuela  
*Glipostena dimorpha* (147): Sulawesi  
*Glipostena hogsbacki* (147): Sulawesi  
*Glipostena medleri* (147): Nigeria  
*Glipostena nemoralis* (65): Angola  
*Glipostena nigricans* (148): Filippine  
*Glipostenoda bellmarleyi* (59): Sudafrica  
*Glipostenoda bellonae* (96): Is. Salomone, Bellona  
*Glipostenoda durbanica* (59): Sudafrica  
*Glipostenoda falsomultistrigosa* (73): Sudafrica  
*Glipostenoda monostrigosa* (59): Sudafrica  
*Glipostenoda permira* (65): Angola  
*Glipostenoda quinquestrigosa* (59): Sudafrica  
*Glipostenoda subflavescens* (59): Sudafrica  
*Gymnostena* n. gen. (22)  
*Gymnostena holosericea* (22): Sudafrica  
*Hoshihananomia pseudoelegans* (30): Sudafrica  
*Ideorhipistena* n. gen. (149)  
*Ideorhipistena occipitalis* (149): Is. Bismarck  
*Machairophora* n. gen. (9)  
*Machairophora paolii* (9): Guatemala  
*Macroglipa* n. subg. di *Neoglipa* (29) (considerato sottogenere di *Glipa* LeConte, 1857 in 44)  
*Mordella* (s. str.) *africana* (38): Sudafrica  
*Mordella* (s. str.) *brincki* (71): Namibia  
*Mordella* (s. str.) *caprai* (24): Albania (trasferita poi a *Variimorda* (*Galeimorda*) in 139)  
*Mordella* (s. str.) *hoshihanamima* (71): Sudafrica  
*Mordella* (s. str.) *pondolandiae* (71): Sudafrica  
*Mordella* (s. str.) *rudebecki* (71): Sudafrica



- Mordella* (s. str.) *tabulae* (71): Sudafrica  
*Mordella* (s. str.) *turneri* (71): Sudafrica  
*Mordella argyroleura* (3): Italia, Is. Capraia (trasferita poi a *Variimorda* (s. str.) in 139)  
*Mordella castellanii* (15): Italia, Lazio (= sinonimo di *Mediimorda bipunctata* (Germar, 1827) in 139)  
*Mordella quomoi* (2): Italia, Is. Giglio, corretta in *cuomoi* (3) e trasferita poi a *Variimorda* (s. str.) in 139, ma nuovamente come *quomoi*  
*Mordella pseudobrachyura* (15): Austria, Stiria  
*Mordellaria africana* (52): Sudafrica  
*Mordellaria hessei* (71): Sudafrica  
*Mordellina* (s. str.) *hypopygialis* (65): Angola  
*Mordellina* (s. str.) *misella* (65): Angola  
*Mordellina* (s. str.) *monocalcarata* (73): Lesotho  
*Mordellina* (s. str.) *splendidula* (65): Angola  
*Mordellina* (*Pseudomordellistena*) *aureopubens* (73): Sudafrica  
*Mordellina* (*Pseudomordellistena*) *aureosplendens* (65): Angola  
*Mordellina* (*Pseudomordellistena*) *brachyacantha* (138): Sierra Leone  
*Mordellina* (*Pseudomordellistena*) *lampros* (65): Angola  
*Mordellina* (*Pseudomordellistena*) *parcestrigosa* (138): Sierra Leone  
*Mordellistena* (s. str.) *aegea* (15): Grecia, Is. Kos  
*Mordellistena* (s. str.) *anaspoides* (73): Sudafrica  
*Mordellistena* (s. str.) *angustatissima* (73): Sudafrica  
*Mordellistena* (s. str.) *antennaria* (39): Senegal  
*Mordellistena* (s. str.) *arabissa* (53): Yemen, Aden  
*Mordellistena* (s. str.) *balianii* (5): Italia, Sicilia  
*Mordellistena* (s. str.) *bambeyana* (39): Senegal  
*Mordellistena* (s. str.) *bevisi* (52): Sudafrica  
*Mordellistena* (s. str.) *caudatissima* (73): Sudafrica  
*Mordellistena* (s. str.) *cupreipennis* (73): Sudafrica  
*Mordellistena* (s. str.) *dahomeyana* (39): Benin (= Dahomey)  
*Mordellistena* (s. str.) *elicodomma* (73): Sudafrica  
*Mordellistena* (s. str.) *estcourtensis* (73): Sudafrica  
*Mordellistena* (s. str.) *flavofrontalis* (52): Sudafrica  
*Mordellistena* (s. str.) *fletcheri* (39): Uganda, Ruwenzori (poi descritta come n. sp. in 60)  
*Mordellistena* (s. str.) *ghanii* (78): Pakistan  
*Mordellistena* (s. str.) *gibbosa* (73): Sudafrica  
*Mordellistena* (s. str.) *humeralis* ab. *sanfilippoi* (1): Italia, Liguria  
*Mordellistena* (s. str.) *irritans* (129): Italia, Is. Lampedusa  
*Mordellistena* (s. str.) *lawrencei* (73): Mozambico  
*Mordellistena* (s. str.) *lonai* (15): Albania  
*Mordellistena* (s. str.) *longelytrata* (73): Sudafrica  
*Mordellistena* (s. str.) *marginiloba* (73): Sudafrica  
*Mordellistena* (s. str.) *nigrimacula* (73): Sudafrica  
*Mordellistena* (s. str.) *noctivaga* (65): Angola



- Mordellistena* (s. str.) *obliquestrigosa* (73): Sudafrica  
*Mordellistena* (s. str.) *ocularis* (73): Sudafrica  
*Mordellistena* (s. str.) *parumstrigosa* (73): Sudafrica  
*Mordellistena* (s. str.) *perantennata* (73): Sudafrica  
*Mordellistena* (s. str.) *permira* (15): Grecia, Is. Rodi  
*Mordellistena* (s. str.) *potamophila* (65): Angola  
*Mordellistena* (s. str.) *praetoriana* (73): Sudafrica  
*Mordellistena* (s. str.) *problematica* (30): Zimbabwe  
*Mordellistena* (s. str.) *pseudolatipalposa* (73): Sudafrica  
*Mordellistena* (s. str.) *salisburiana* (73): Zimbabwe  
*Mordellistena* (s. str.) *schatzmayri* (15): Grecia, Macedonia  
*Mordellistena* (s. str.) *simillima* (52): Sudafrica  
*Mordellistena* (s. str.) *solarii* (5): Italia, Sardegna  
*Mordellistena* (s. str.) *swierstrai* (60): Sudafrica (descritta come n. sp. anche in 73)  
*Mordellistena* (s. str.) *testaceithorax* (73): Sudafrica  
*Mordellistena* (s. str.) *thoracalis* (73): Sudafrica  
*Mordellistena* (s. str.) *umbra* (13): Italia, Umbria  
*Mordellistena* (s. str.) *villiersi* (39): Guinea  
*Mordellistena* (s. str.) *xanthonota* (39): Senegal  
*Mordellistena* (*Mordellokoiles*) *grandii* (6): Italia, Calabria (= *Mordellokoiles grandii* in 139)  
*Mordellistena* (*Pseudomordellina*) *agadeziana* (39): Niger  
*Mordellistena* (*Pseudomordellina*) *multicolor* (73): Sudafrica  
*Mordellistena* (*Pseudomordellina*) *nyctaletes* (65): Angola  
*Mordellistena* (*Pseudomordellina*) *pumilioides* (39): Senegal  
*Mordellistena* (*Pseudomordellina*) *semlikiana* (39): Uganda, Ruwenzori (descritta come n. sp. anche in 60)  
*Mordellistena* (*Pseudomordellina*) *zululandiae* (52): Sudafrica  
*Mordellistena* (*Tolida*) *caprai* (2): Italia, Is. Giglio (trasferita poi a *Mordellistena* (s. str.) in 139)  
*Mordellistena* (*Tolida*) *caprai* ab. *distinctemaculata* (2): Italia, Is. Giglio (trasferita poi a *Mordellistena* (s. str.) in 139)  
*Mordellistena* (*Tolida*) *manteroi* (5): Italia, Liguria (trasferita poi a *Mordellistena* (s. str.) in 139)  
*Mordellokoiles* n. subg. di *Mordellistena* (6) (considerato poi genere a sé stante in 139)  
*Mordellopalpus* n. gen. (42)  
*Mordellopalpus antennarius* (42): Molucche, Is. Buru  
*Mordelloxena* n. gen. (22)  
*Mordelloxena anaspoides* (22): Sudafrica  
*Neocurtimorda* n. gen. (16) (= sinonimo di *Sphalera* LeConte, 1859 in 34, ma poi rivalidato in 38)  
*Neocurtimorda aequatorialis* (34): Is. S. Thomé  
*Neocurtimorda belcastroi* (138): Sierra Leone  
*Neocurtimorda conformis* (34): Namibia



- Neocurtimorda convexa* (16): Birmania  
*Neocurtimorda distigma* (38): Sudafrica  
*Neocurtimorda monostigma* (34): Sudafrica  
*Neocurtimorda mordelloides* (34): Sudafrica  
*Neocurtimorda nakanei* (34): Guinea Equatoriale  
*Neocurtimorda perpusilla* (34): Namibia  
*Neocurtimorda picicornis* (34): Namibia  
*Neocurtimorda rufipalpis* (34): Zimbabwe  
*Neocurtimorda sexmaculata* (34): Sudafrica  
*Neoglipa* n. gen. (28) (= sinonimo di *Glipa* LeConte s. str. in 44)  
*Neoglipa* (s. str.) *oxygonia* (29): Nuova Guinea (trasferita poi a *Glipa* s. str. in 44)  
*Neoglipa* (*Macroglipa*) *iridescent* (29): Nuova Guinea (trasferita poi a *Glipa* (*Macroglipa*) in 44)  
*Neoglipa* (*Macroglipa*) *novaeguineae* (29): Nuova Guinea (trasferita poi a *Glipa* (*Macroglipa*) in 44)  
*Neoglipa* (*Stenoglipa*) *griseopubens* (29): Nuova Guinea (trasferita poi a *Glipa* (*Stenoglipa*) in 44)  
*Neomordellina* n. subg. di *Neomordellistena* (73)  
*Neomordellistena* (s. str.) *crassipennis* (73): Zimbabwe  
*Neomordellistena* (s. str.) *houtiensis* (73): Sudafrica  
*Neomordellistena* (s. str.) *testaceispina* (73): Sudafrica  
*Ophthalmoglipa* n. gen. (28)  
*Ophthalmoglipa australis* (29): Nuova Guinea  
*Parastenomordella ensifera* (117): Argentina  
*Paratomoxioda bioculata* (71): Namibia  
*Paratomoxioda brevis* (71): Namibia  
*Paratomoxioda capensis* (71): Sudafrica  
*Paratomoxioda fenestrata* (71): Namibia  
*Paratomoxioda grandipalpis* (71): Namibia  
*Paratomoxioda novemguttata* (71): Namibia  
*Paratomoxioda testaceipalpis* (71): Namibia  
*Paratomoxioda uncinata* (71): Namibia  
*Plesitomoxia sericea* (71): Sudafrica  
*Pselaphokentron* n. gen. (42)  
*Pselaphokentron aculeatum* (125): Sierra Leone  
*Pselaphokentron bradypygum* (42): Uganda  
*Pselaphostena* n. gen. (19) (poi descritto come n. gen. anche in 30)  
*Pselaphostena antennata* (26): Sudafrica  
*Pselaphostena arnoldi* (19): Zimbabwe (descritta come n. sp. anche in 30)  
*Pselaphostena arnoldi* var. *quadristrigosa* (26): Sudafrica  
*Pselaphostena calcarata* (57): Sudafrica  
*Pselaphostena diversicornis* (26): Sudafrica  
*Pselaphostena fulvosignata* (57): Zimbabwe  
*Pselaphostena longepalpalis* (26): Sudafrica



- Pselaphostena longepalpalis* ssp. *montana* (57): Lesotho  
*Pselaphostena occidentalis* (57): Namibia  
*Pselaphostena praetoriana* (26): Sudafrica  
*Pselaphostena pulchripennis* (57): Sudafrica  
*Pselaphostena rhodesiensis* (26): Zimbabwe  
*Pselaphostena vansoni* (26): Sudafrica  
*Pseudotolida aequispina* (96): Is. Salomone, Rennell  
*Pseudotomoxia mosseliana* (71): Sudafrica  
*Pseudotomoxia palpalis* (71): Namibia  
*Raymordella* n. gen. (52)  
*Raymordella* (s. str.) *ambigua* (52): Sudafrica  
*Ramyordella* (s. str.) *adusta* (73): Sudafrica  
*Raymordella* (s. str.) *transversalis* (73): Sudafrica  
*Raymordella* (*Raymordellina*) *xanthosoma* (73): Sudafrica  
*Raymordellina* n. subg. di *Raymordella* (73)  
Reynoldsiellini n. trib. (57)  
*Sphaeromorda* n. gen. (22)  
*Sphaeromorda magnithorax* (71): Sudafrica  
*Sphaeromorda natalensis* (22): Sudafrica  
*Sphaeromorda velutinoides* (71): Sudafrica  
*Stenalia abyssinica* (57): Etiopia (descritta come n. sp. anche in 62)  
*Stenalia arnoldi* (20): Zimbabwe (trasferita poi a *Stenaliodes* in 52)  
*Stenalia australis* (52): Sudafrica  
*Stenalia balcanica* (15): Albania  
*Stenalia brachyptera* (57): Sudafrica  
*Stenalia dollmani* (57): Zimbabwe (descritta come n. sp. anche in 62)  
*Stenalia ermischi* (8): Rep. Dem. Congo  
*Stenalia ermischi* ab. *melanoskela* (8): Rep. Dem. Congo  
*Stenalia gridellii* (15): Grecia, Is. Kos  
*Stenalia karossiana* (57): Namibia  
*Stenalia macrocephala* (57): Zimbabwe (descritta come n. sp. anche in 62)  
*Stenalia nyakanensis* (57): Mozambico  
*Stenalia occidentalis* (39): Senegal  
*Stenalia turneri* (57): Sudafrica  
*Stenalia zululandiae* (57): Sudafrica  
Stenaliini n. trib. (38) (descritta come n. trib. anche in 52)  
*Stenaliodes* n. gen. (52) (come nomen nudum in 38)  
*Stenoglipa* n. subg. di *Neoglipa* (29) (considerato sottogenere di *Glipa* in 44)  
*Stenomordella macrocera* (71): Sudafrica  
*Tomoxia eligmographa* (96): Is. Salomone, Rennell  
*Trichotomoxia* n. gen. (19)  
*Trichotomoxia chubbi* (19): Sudafrica  
*Trichotomoxia grosseantennalis* (39): Costa d'Avorio  
*Wittmerimorda* n. gen. (33)



*Wittmerimorda gymnophthalma* (33): Brasile  
*Xanthoconalia* n. gen. (8)  
*Xanthoconalia patrizii* (8): Rep. Dem. Congo  
*Xanthoconalia timossii* (8): Somalia  
*Yakuhananomia ermischi* (25): Is. S. Thomé  
*Zeamordella brouni* (96): Is. Salomone, Rennell  
*Zeamordella caprai* (131): Sulawesi

In totale: 1 subfam., 2 tribù, 24 gen., 4 subgen., 199 spp., 1 ssp., 3 ab., 1 var.

### Coleoptera Scraptiidae

*Akentra* n. gen. (36)  
*Akentra balfourbrownei* (36): Sudafrica  
*Akentra basicornis* (36): Sudafrica  
*Akentra chakratiana* (40): India  
*Akentra inoptata* (36): Sudafrica  
*Anaspella antennata* (35): Libia  
*Anaspimordini* n. trib. (36)  
*Anaspis* (s. str.) *lucana* (10): Italia, Campania  
*Anaspis* (s. str.) *poggii* (97): Italia, Sardegna  
*Anaspis* (s. str.) *teratopyga* (15): Bosnia-Erzegovina  
*Anaspis* (*Larisia*) *akaira* (129): Italia, Is. Lampedusa  
*Anaspis* (*Larisia*) *meridionalis* (53): Yemen, Aden  
*Anaspis* (*Pinassa*) *lindbergi* (45): Grecia, Creta  
*Anaspis* (*Pinassa*) *walteriana* (133): Kenya  
*Anaspis* (*Silaria*) *mancinii* (3): Italia, Is. Capraia  
*Anaspis* (*Silaria*) *mancinii* ab. *erythrata* (3): Italia, Is. Capraia  
*Anaspis* (*Silaria*) *thoracoxantha* (10): Italia, Campania  
*Anaspis* (*Spanisa*) *subhumerosa* (36): Sudafrica  
*Cryptanaspis* n. gen. (53)  
*Cryptanaspis brittoni* (53): Yemen, Aden  
*Cyrtoscraptia* nom. nud. (69): cfr. *Menuthianaspis*  
*Ectasiocnemis* n. gen. (43)  
*Ectasiocnemis caneparii* (118): India  
*Ectasiocnemis hazariana* (43): India  
*Ectasiocnemis inermis* (43): India  
*Ectasiocnemis laciniata* (63): Afghanistan  
*Ectasiocnemis maxima* (43): India  
*Menuthianaspidini* n. trib. (77)  
*Menuthianaspis* n. gen. (77) (= *Cyrtoscraptia* Franciscolo, nom. nud.)  
*Naucles reventazoni* (77): Costa Rica  
*Pentaria debarrosmachadoi* (65): Angola  
*Pentaria phoenix* (53): Yemen, Aden



Pentariini n. trib. (36)

*Pseudopentaria* n. gen. (53)

*Pseudopentaria scotti* (53): Yemen, Aden

*Rhabdanaspis* nom. nov. (= pro *Rhabdocnemis* Franciscolo, 1956 nec Faust, 1894) (77)

*Rhabdocnemis* n. gen. (47)

*Scryptia* (s. str.) *adenensis* (53): Yemen, Aden

*Zoianaspis* n. gen. (133)

*Zoianaspis subaptera* (133): Kenya

In totale: 3 tribù, 7 gen. (+ 1 nom. nov. e 1 nom. nud.), 27 spp., 1 ab.

### Coleoptera Lucanidae

*Nigidius walterianus* (137): Sierra Leone

In totale: 1 sp.

### Coleoptera varia

Thylodriidae n. fam. (83)

Thylodrioidea n. superfam. (83)

In totale: 1 superfam., 1 fam.

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Nard BENNAS & Carmen Elisa SÀINZ-CANTERO

**Coléoptères aquatiques Adephaga  
de la chaîne rifaine marocaine**  
(Coleoptera Gyrinidae, Haliplidae,  
Noteridae, Hygrobiidae, Dytiscidae)

**Résumé** - Une étude sur 4041 individus adultes de Coléoptères aquatiques Adephaga récoltés dans diverses localités de la chaîne rifaine marocaine a permis l'identification de 61 espèces dont une (*Hydroporus memnonius*) s'avère nouvelle pour le Maroc et 6 pour le territoire rifain. Les données obtenues lors des prospections et la compilation des citations bibliographiques concernant ce groupe d'insectes, ont permis la réalisation de l'inventaire des 81 espèces connues jusqu'à présent pour les neuf provinces faisant partie du Rif.

**Abstract** - *Adephagous water beetles of the Moroccan Rif (Coleoptera Gyrinidae, Haliplidae, Noteridae, Hygrobiidae, Dytiscidae).*

We have studied 4041 specimens of Coleoptera belonging to the suborder Adephaga collected during random sampling carried out at different sites in the Rif Mountain (northern Morocco). 61 species were found, 7 of them previously unknown in the studied area. *Hydroporus memnonius* is new for Morocco. Data about the catches and biogeographical distribution are given and all the literature records of Hydradephaga (81 species) of the Rif are compiled.

**Riassunto** - *Gli Idroade fisi della catena del Rif marocchino (Coleoptera Gyrinidae, Haliplidae, Noteridae, Hygrobiidae, Dytiscidae).*

Lo studio di 4041 esemplari di Idroade fisi catturati in diverse località del Rif (Marocco settentrionale), ha permesso di identificare 61 specie, una delle quali (*Hydroporus memnonius*) è segnalata per la prima volta per il Marocco e 6 per il massiccio del Rif. Questi dati, insieme a quelli ottenuti dall'esame della bibliografia, hanno permesso di realizzare l'inventario degli Idroade fisi (81 specie) sinora conosciuti nelle nove province che fanno parte del Rif.

**Key words:** Coleoptera, Gyrinidae, Haliplidae, Noteridae, Hygrobiidae, Dytiscidae, Rif (N Morocco).

## INTRODUCTION

L'importance du Rif, en tant que zone de passage obligatoire pour une grande partie de la faune paléarctique qui a colonisé le continent africain, et sa proximité de l'Europe font de cette région du Maroc une zone à intérêt particulier pour les études faunistiques et biogéographique (Bennas et al., 1992). Malgré ces atouts, le Rif manque cruellement d'études entomologiques. Dans le cas des Coléoptères aquatiques, des travaux de catalogation spécifique, couvrant l'ensemble du territoire rifain et dont la réalisation nécessite d'intenses prospections, font totalement défaut. Ainsi, dans le but de contribuer à l'étude des Coléoptères aquatiques du Maroc en général et du Rif en particulier, nous avons entamé depuis 1991 une étude complète et exhaustive relative à tout le Rif. Dans un précédent travail (Bennas et al., 2001) nous nous étions intéressées à la famille des Hydraenidae; la présente étude porte sur le sous ordre des Adephaga.



Les premières données sur les Adephaga du Rif sont due à Escalera (1914) qui, dans son ouvrage sur les coléoptères du Maroc, cite 39 espèces à Tanger. Une décennie après, Bedel (1925) dans son catalogue sur les Coléoptères du Nord de l'Afrique, reprend les citations de Escalera (1914) et ajoute 10 autres espèces au catalogue des Adephaga de Tanger. Toujours dans cette dernière localité, Lindberg (1939) fait mention de deux autres espèces élevant ainsi à 51 le nombre d'Adephaga aquatiques connues à Tanger et ses alentours. Au coeur de la montagne rifaine à Jbel Tidghine, Guignot (1946) ajoute un nouveau *Agabus* Leach, 1817 à la faune rifaine élevant à 52 le nombre des Adephaga aquatique du Rif. Les contributions de Lagar Mascaró (1946, 1968) méritent une mention spéciale. Ce sont en faite les seuls travaux qui ont été réalisés exclusivement sur une localité rifaine: Ceuta. Ces travaux ont permis l'addition au catalogue du Rif, de quatre autres espèces, dont une est tombée en synonymie (Fery & Brancucci, 1997). Dans les années cinquante et soixante apparaissent les travaux de Kocher (1954, 1958, 1964, 1969), sur lesquels on a pu relever les citations de cinq espèces nouvelles pour le Rif. Trente années plus tard, les Adephaga du Rif sont de nouveaux touchés par des travaux, permettant ainsi l'addition de 13 autres espèces au catalogue rifain (Bennas, 1987; Balke et al., 1990; Bennas, 1990; Vondel, 1991; Bennas et al., 1992; Fery et al., 1996; Fery & Brancucci, 1997; Chavanon et al., 2004).

De l'ensemble de ces travaux, il ressort clairement que toutes les données existantes sur les Adephaga du Rif, sont en faites très fragmentaires de telle sorte qu'elles ne couvrent pas l'ensemble du territoire rifain.

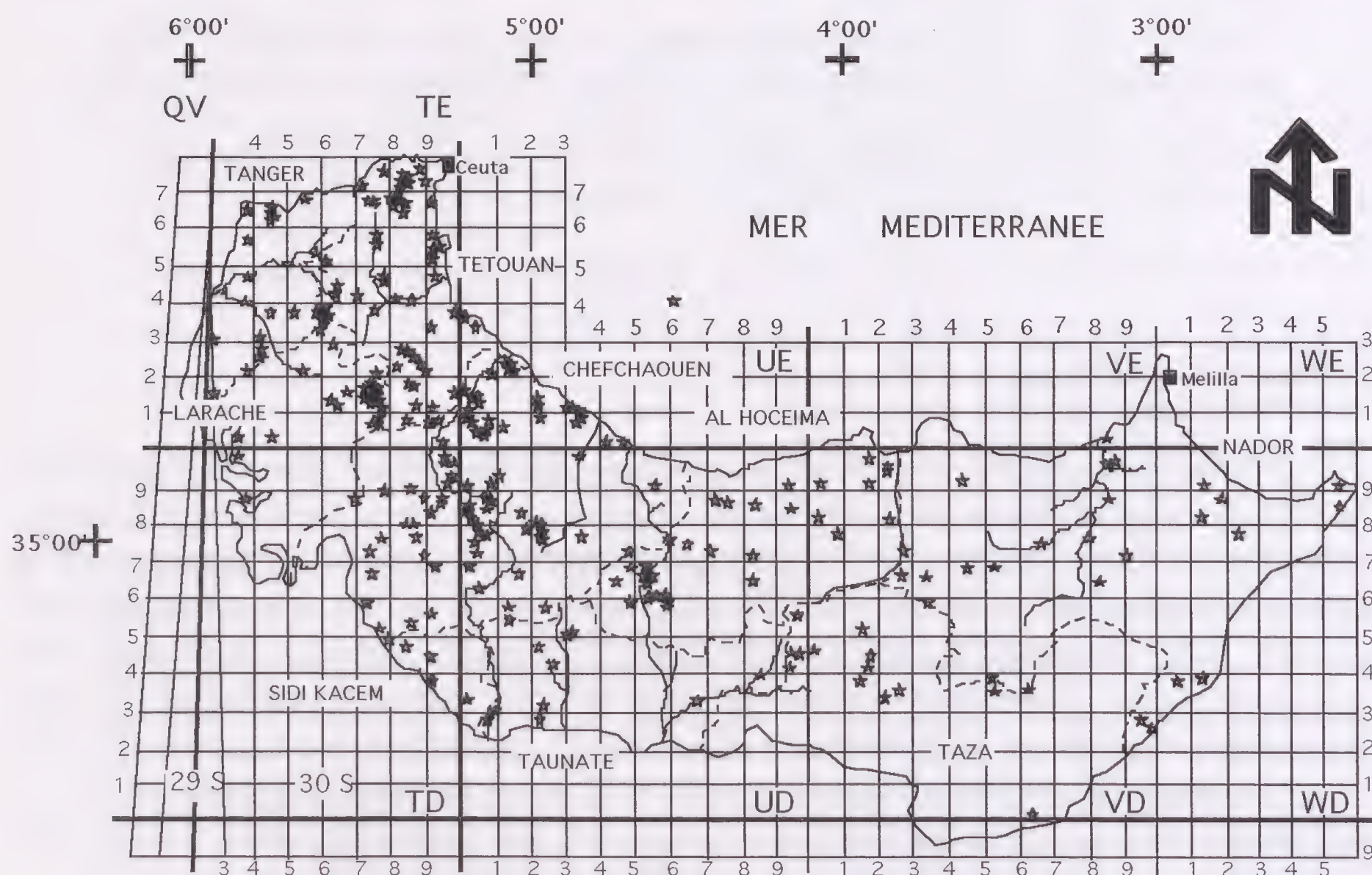


Fig. 1 - Aire d'étude et localisation des stations prospectées. Echelle: 1 carré: 10 Km.



## AIRE D'ETUDE

L'aire d'étude limitée selon les critères considérés par Fahd & Pleguezuelos (1993), correspond à la partie septentrionale du Maroc. Elle commence depuis les confins du détroit de Tanger et s'étend à l'Est, jusqu'à l'oued Moulouya, ayant comme limite méridionale le tracé capricieux des cours d'eau de Ouerrha et de Msoun qui débouche dans l'oued Moulouya. Le détroit de Gibraltar, la mer méditerranée et l'océan atlantique bordent respectivement les limites Nord et Ouest (fig. 1). La zone d'étude englobe la totalité des provinces de Tétouan, de Tanger, d'Al Hoceima et de Nador, une grande partie de la province de Larache, exception faite de l'extrême Sud-Ouest et également les parties septentrionales relatives aux provinces de Taza, de Taounate et de Sidi Kacem.

## MATERIELS ET METHODES

Les prospections sur le terrain se sont déroulées entre 1991 et l'an 2000. Depuis un total de 270 stations ont été retenues et prospectées d'une manière ponctuelle. L'appendice 1 dresse la liste des 270 stations prospectées qui sont classées par provinces. Un code est attribué à chaque station qui sera utilisé pour désigner le matériel étudié.

Dans le travail traitant la famille des Hydraenidae (Bennas et al., 2001), figure une description succincte des caractéristiques physiques de l'aire d'étude et la méthodologie de capture. Dans le présent travail, nous présentons une compilation de toutes les données recueillies, aussi bien de la littérature que de récoltes personnelles, concernant les Coléoptères aquatiques Adephaga du domaine rifain. Les espèces récoltées sont conservées après détermination dans de l'alcool 96 à 70% dans des tubes dûment étiquetés, lesquels sont déposés au Département de Biologie de la faculté des sciences de Tétouan.

L'ordre générique et spécifique suit le tout récent catalogue de Löbl & Smetana (2003) et les catégories chorologiques des espèces ont été établies selon le schéma chorologique de Vigna Taglianti et al. (1993, 1999).

## RESULTATS

Des 270 stations prospectées (Appendice 1), 204 ont présenté des Hydradephaga ce qui correspond à 75% du total. Lors des études effectuées dans ces stations 4041 individus adultes (1759 mâles et 2283 femelles) appartenant à ce groupe ont été capturés. L'étude taxonomique nous a permis d'identifier 61 espèces dont cinq appartiennent aux familles des Haliplidae et des Gyrinidae, une seule espèce à celles des Noteridae et des Hygrobiidae et 49 espèces à celle des Dytiscidae. En plus des espèces capturées la liste des Hydradephaga du Rif se complète avec 20 autres espèces, qui ont été préalablement citées (tab. 1) et qui n'ont pas été localisées durant nos prospections.

Du catalogue des Hydradephaga du Rif ont été exclues les espèces *Haliphus* (*Lia-phlus*) *fulvus* (Fabricius, 1801) et *Agabus conspersus* (Marsham, 1802) citées à Tanger par Fairmaire (1858 in Bedel, 1925) et Escalera (1914) respectivement, et ce selon Bedel (1925) pour la première espèce et Kocher (1958) pour la deuxième qui ont remis en cause ces deux citations. Toutefois leur présence au Rif serait probable puisque les deux espèces sont connues dans le reste du Maroc (Vondel, 1991; Löbl & Smetana, 2003).



Le catalogue des Adephaga aquatique du Rif se présente donc comme suit:

### Gyrinidae

#### *Aulonogyrus (Aulonogyrus) striatus* (Fabricius, 1792)

MATÉRIEL ÉTUDIÉ. Alhoceima. S-2: 11-VI-1991, 8 ♂♂ et 11 ♀♀. S-14: 16-III-1998, 1 ♀. S-16: 22-VI-1998, 2 ♂♂ et 3 ♀♀. S-19: 22-VI-1998, 1 ♂ et 2 ♀♀. Chefchaouen. S-34: 7-V-1993, 1 ♀. S-35: 7-V-1993, 4 ♂♂ et 8 ♀♀. S-36: 30-IV-1997, 1 ♂. S-39: 9-VI-1991, 21 ♂♂ et 15 ♀♀. S-41: 30-IV-1997, 1 ♂♂. S-43: 28-VIII-1994, 2 ♂♂. S-45: 28-VIII-1994, 7 ♂♂. S-46: 30-IV-1997, 2 ♂♂ et 1 ♀. S-51: 17-IV-1997, 1 ♂ et 2 ♀♀. S-53: 7-X-1991, 4 ♀♀. S-69: 3-VI-1992, 1 ♂. S-72: 30-IV-1997, 1 ♂ et 6 ♀♀. S-73: 30-IV-1997, 1 ♂ et 1 ♀. S-78: 17-IV-1997, 1 ♀. S-80: 30-IV-1997, 1 ♂ et 2 ♀♀. S-86: 24-IV-1995, 1 ♂ et 1 ♀. S-91: 22-VI-1998, 1 ♂ et 1 ♀. S-109: 22-VI-1998, 1 ♂ et 7 ♀♀. Larache. S-116: 10-VII-1991, 31 ♂♂ et 18 ♀♀. S-121: 10-VII-1991, 1 ♂. S-128: 21-III-1997, 3 ♂♂ et 2 ♀♀. Nador. S-147: 11-VI-1991, 3 ♂♂ et 2 ♀♀. S-152: 12-VI-1991, 4 ♂♂. S-153: 14-VI-1991, 1 ♂. S-154: 4-VI-1999, 1 ♀. S-160: 13-VI-1991, 1 ♂ et 3 ♀♀. Tanger. S-169: 6-X-1991, 9 ♂♂ et 6 ♀♀. S-172: 9-VII-1991, 4 ♂♂ et 4 ♀♀. Taza. S-201: 13-VI-1991, 6 ♂♂ et 2 ♀♀. S-203: 13-VI-1991, 4 ♂♂ et 9 ♀♀. S-205: 9-X-1991, 3 ♂♂ et 12 ♀♀. S-213: 5-VI-1999, 1 ♀. Tetouan. S-226: 9-VI-1991, 3 ♂♂ et 5 ♀♀. S-232: 12-VII-1991, 3 ♂♂ et 6 ♀♀. S-234: 18-VI-1998, 1 ♂. S-235: 12-VII-1991, 1 ♂ et 2 ♀♀. S-236: 18-VI-1998, 1 ♂. S-237: 21-III-1997, 1 ♂. S-238: 21-III-1997, 1 ♂ et 2 ♀♀. S-241: 9-VII-1991, 1 ♂. S-242: 9-VII-1991, 10 ♂♂ et 14 ♀♀. S-243: 8-V-1993, 1 ♂ et 3 ♀♀. S-247: 12-VII-1991, 3 ♂♂ et 6 ♀♀. S-248: 8-VI-1991, 24 ♂♂ et 23 ♀♀. S-256: 24-IV-1995, 1 ♂.

Espèce de distribution Méditerranéenne avec une extension dans les îles Canaries, au Maroc elle est connue avec certitude, dans sa partie orientale dans les environs de Oujda (Bedel, 1925; Berrahou, 1995; Chavanon et al., 2004), sur sa façade atlantique, dans la Meseta côtière (Escalera, 1914; El Alaoui, 1985) et à Essaouira (Escalera, 1914; Bedel, 1925) et dans le Moyen Atlas, aux environs d'Azrou (Lindberg, 1939; Kocher, 1958). Dans le Haut Atlas, elle a été citée à Taroudant (Escalera, 1914) et aux environs de Marrakech (Lindberg, 1939; Guignot, 1946; Mezdi & Giudicelli, 1986; Ajakane, 1998). La distribution de l'espèce se continue jusqu'au domaine saharien (Kocher & Reymond, 1954; Kocher, 1958). Au Rif, elle a été connue jusque ici que de la localité concrète de l'Anassar (Bab-Berret) de la province de Chefchaouen (Bennas, 1990). Nos captures dans les provinces d'Al Hoceima, Larache, Nador, Tanger, Taza et Tétouan, élargissent considérablement son aire de répartition à l'ensemble de l'aire d'étude.

#### *Gyrinus (Gyrinus) caspius* Ménétries, 1832

MATÉRIEL ÉTUDIÉ. Tetouan. S-215: 28-II-1992, 4 ♂♂ et 5 ♀♀. S-222: 28-II-1992, 22 ♂♂. S-242: 9-VII-1991, 1 ♀.

Elément Turanique-Européenne avec extension au Maroc et en Algérie. Au Maroc, l'espèce est connue entre Kénitra et Casablanca sur le littoral atlantique (Kocher, 1958; El Alaoui, 1983, 1985) et à Boulmane, à Sefrou et à Ifrane (Kocher, 1958; Dakki, 1979) au Moyen Atlas. Dans le Rif, elle est connue uniquement à Tétouan (Kocher, 1958; Bennas, 1987, 1990).



*Gyrinus (Gyrinus) dejeani* Brullé, 1832

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-24: 4-VI-1992, 1 ♂. Chefchaouen. S-35: 7-V-1993, 1 ♂ et 1 ♀. S-39: 9-VI-1991, 2 ♀ ♀. S-43: 28-VIII-1994, 20 ♂ ♂ et 35 ♀ ♀. S-46: 30-IV-1997, 2 ♂ ♂ et 1 ♀. S-48: 28-VIII-1994, 10 ♂ ♂ et 11 ♀ ♀. S-69: 3-VI-1992, 5 ♂ ♂ et 8 ♀ ♀. S-73: 30-IV-1997, 2 ♂ ♂ et 2 ♀ ♀. S-78: 17-IV-1997, 1 ♂ et 2 ♀ ♀. S-89: 13-IV-1999, 1 ♀. S-91: 22-VI-1998, 1 ♂ et 2 ♀ ♀. S-92: 4-VI-1992, 7 ♀ ♀. S-111: 28-IX-1993, 1 ♀. Larache. S-116: 10-VII-1991, 3 ♂ ♂ et 6 ♀ ♀. S-127: 21-III-1997, 1 ♂ et 1 ♀. S-128: 21-III-1997, 20 ♂ ♂ et 15 ♀ ♀. Nador. S-147: 11-VI-1991, 1 ♂ et 1 ♀. S-154: 4-VI-1999, 1 ♀. S-160: 13-VI-1991, 2 ♂ ♂ et 10 ♀ ♀. Tanger. S-169: 6-X-1991, 1 ♀. Taza. S-203: 13-VI-1991, 1 ♂ et 2 ♀ ♀. S-214: 5-VI-1999, 1 ♂ et 2 ♀ ♀. Tetouan. S-222: 28-II-1992, 12 ♂ ♂ et 35 ♀ ♀. S-227: 9-VI-1991, 19 ♂ ♂ et 13 ♀ ♀. S-239: 23-III-1997, 5 ♂ ♂ et 9 ♀ ♀. S-241: 9-VII-1991, 3 ♂ ♂ et 3 ♀ ♀. S-242: 9-VII-1991, 1 ♂ et 1 ♀. S-243: 8-V-1993, 5 ♂ ♂ et 13 ♀ ♀. S-247: 12-VII-1991, 2 ♂ ♂. S-255: 23-III-1997, 1 ♂.

Espèce de distribution Euro-Méditerranéenne en plus des îles Canaries, au Maroc, elle est mentionnée dans quelques localités de la façade atlantique du pays, de Kénitra à Casablanca (Escalera, 1914; Bedel, 1925; Lindberg, 1939; El Alaoui, 1983, 1985) et à Essaouira (Escalera, 1914; Bedel, 1925; Lindberg, 1939). Au Maroc oriental, elle est citée à Oujda (Bedel, 1925; Berrahou, 1995, Chavanon et al., 2004). Au Moyen Atlas, elle est signalée à Azrou (Lindberg, 1939) et à Ifrane (Kocher, 1958) et en fin au Sud elle est citée dans le Haut Atlas aux environs de Marrakech (Escalera, 1914; Bedel, 1925; Guignot, 1946). Dans le Rif, elle est connue dans toutes les provinces du secteur occidental (à l'exception de Larache): Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939), Ceuta (Lagar Mascaró, 1946), Tétouan et Chefchaouen (Bennas, 1978, 1990). La capture de cette espèce pour la première fois dans les provinces de Larache, d'Al Hoceima, de Nador et de Taza, prouve que son aire de distribution couvre l'ensemble du territoire rifain.

*Gyrinus (Gyrinus) substriatus* Stephens, 1829

Espèce de distribution Turanique-Européenne avec un prolongement vers les trois pays du Maghreb, connue à présent au Maroc que de trois localités dont une rifaine: Oujda (Kocher, 1958) au Nord-Est du pays, Fès au Moyen Atlas (El Alaoui, 1985) et Tétouan (Bennas, 1987) au Rif. Durant toutes les années de prospections l'espèce n'a pas été retrouvée.

*Gyrinus (Gyrinus) urinator* Illiger, 1807

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-37: 30-IV-1997, 1 ♀. S-39: 9-VI-1991, 2 ♀ ♀. Larache. S-116: 10-VII-1991, 1 ♂. S-117: 8-V-1997, 1 ♂. S-122: 10-VII-1991, 1 ♂. S-127: 21-III-1997, 1 ♀. Tetouan. S-215: 28-II-1992, 7 ♂ ♂ et 9 ♀ ♀. S-222: 28-II-1992, 5 ♂ ♂ et 6 ♀ ♀. S-226: 9-VI-1991, 1 ♂. S-241: 9-VII-1991, 1 ♂. S-242: 9-VII-1991, 1 ♂.

Elément Méditerranéen avec extension au domaine Atlantique, à la Syrie, aux îles Canaries et Madères et un prolongement dans l'Europe centro-orientale. Au Maroc, elle est signalée dans sa partie Nord orientale à Oujda (Bedel, 1925; Berrahou, 1995; Chavanon et al., 2004), sur une portion de son littoral atlantique entre Kénitra et Casablanca (El Alaoui, 1983, 1985), et dans sa partie méridionale dans le Haut Atlas à Marrakech (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Guignot, 1946; Kocher, 1958). Au Rif, connue auparavant que de deux provinces: Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939) et Tétouan (Ben-



nas, 1987, 1990) voit son aire de distribution s'enrichir de neuf localités nouvelles dont six s'avèrent des nouvelles citations pour les provinces de Larache et de Chefchaouen.

*Orectochilus (Orectochilus) villosus bellieri* Reiche, 1861

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-94: 21-VI-2000, 3 ♀ ♀.

Espèce de distribution Sibérico-Européenne, la sous espèce est endémique du Maroc, de l'Algérie, de la Corse et de la Sardaigne. Au Maroc, elle est citée dans le Moyen Atlas à Ifrane (Kocher, 1958), dans le Haut Atlas, aux environs de Marrakech (Lindberg, 1939; Kocher, 1958; Mohati, 1985) et dans la vallée de Sous aux environs d'Agadir (Kocher, 1958). Au Rif, cette espèce a été signalée dans la région de Tétouan (Bennas, 1987). Malgré les nombreuses prospections réalisées dans le Rif, cette espèce n'a été retrouvée que dans une seule localité faisant partie de la province de Chefchaouen pour laquelle elle constitue le premier enregistrement. Ces mœurs nocturnes (Focarile, 1960; Lagar Mascaró, 1967; Holmen, 1987); seraient probablement la cause de ce manque de captures.

### Haliplidae

*Haliplus (Liaphlus) andalusicus* Wehncke, 1874

MATÉRIEL ÉTUDIÉ. Tetouan. S-215: 28-II-1992, 1 ♀. S-222: 28-II-1992, 1 ♂.

Espèce de distribution Ouest-Méditerranéenne. Au Maroc, signalée depuis le début du XX<sup>e</sup> siècle (Escalera, 1914) sans localité précise, n'a été recensée avec précision qu'au Moyen Atlas aux environs de Fès (Bertrand, 1936; Kocher, 1958) et de quelques localités de la façade atlantique du pays: Tanger (Lindberg, 1939; Bedel, 1925; Kocher, 1958, Vondel, 1991), Meseta côtière entre Kénitra (Bedel, 1925) et Casablanca (El Alaoui, 1985) et Essaouira (Kocher, 1958). Dans le Rif, en plus de Tétouan (Bennas, 1987) elle a été répertoriée à Tanger (Vondel, 1991). Il s'agit sans doute d'une espèce rare dans l'aire d'étude.

*Haliplus (Liaphlus) mucronatus* Stephens, 1832

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-2: 11-VI-1991, 2 ♂ ♂ et 4 ♀ ♀. Chefchaouen. S-39: 9-VI-1991, 2 ♀ ♀. Taounate. S-199: 23-VII-1999, 1 ♂. Tetouan. S-262: 27-IX-1993, 1 ♀.

Elément Euro-Méditerranéen, sa présence au Maroc a été mentionné depuis le début du XX<sup>e</sup> siècle par Escalera (1914) mais sans localité précise. Plus tard, l'espèce est répertoriée à Marrakech (Lindberg, 1939; Mezdi & Giudicelli, 1986) dans le Haut Atlas, dans les environs de Goulmines dans l'Anti Atlas (Kocher & Reymond, 1954), à Oujda au Maroc oriental, à Casablanca sur le littoral atlantique et à Aïn Leuh près de Azrou dans le Moyen Atlas (Kocher, 1958). L'espèce pourrait avancer jusqu'aux confins du Sahara (Bedel, 1925). Il n'existe par ailleurs aucune mention bibliographique se rapportant à une localité concrète du Rif. Cependant, en se basant sur l'expression de Kocher (1958) "ça et là dans tout le Maroc", l'espèce a été considérée parmi la faune rifaine (Bennas et al., 1992). Les récoltes réalisées dans la zone d'étude nous ont permis de la recenser dans quatre localités et s'avèrent des nouvelles citations pour les provinces d'Al Hoceima, de Chefchaouen, de Taounate et de Tétouan.



*Haliplus (Liaphlus) rubidus* Perris, 1857

Espèce de distribution Ouest-Méditerranéenne avec une extension aux îles Canaries. Au Maroc elle n'est connue que par la seule mention de Tanger (Vondel, 1991) à partir d'une capture qui date de 1895.

*Haliplus (Neohalipus) lineatocollis* (Marsham, 1802)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 1 ♂. S-28: 29-IX-1993, 2 ♂ ♂ et 3 ♀ ♀. Chefchaouen. S-42: 28-VIII-1994, 1 ♀. S-47: 28-VIII-1994, 1 ♀. S-57: 20-VII-1998, 1 ♀. S-69: 3-VI-1992, 1 ♀. S-75: 1-VI-1999, 1 ♀. S-76: 20-VII-1998, 1 ♂ et 1 ♀. S-80: 30-IV-1997, 1 ♂ et 1 ♀. S-82: 22-VIII-1999, 1 ♀. S-96: 13-IV-1999, 1 ♀. S-104: 11-VII-1991, 11 ♂ ♂ et 7 ♀ ♀. S-105: 11-VII-1991, 2 ♂ ♂ et 1 ♀. S-107: 15-VI-1991, 6 ♂ ♂ et 7 ♀ ♀. S-108: 28-IX-1993, 1 ♀. Larache. S-132: 28-VI-1999, 2 ♂ ♂ et 6 ♀ ♀. Nador. S-137: 12-X-1991, 2 ♂ ♂ et 1 ♀. Tanger. S-174: 2-VII-1995, 1 ♀. S-175: 7-III-1999, 3 ♀ ♀. Tetouan. S-215: 28-II-1992, 1 ♂ et 4 ♀ ♀. S-217: 7-V-1993, 5 ♂ ♂ et 3 ♀ ♀. S-220: 25-IX-1994, 3 ♂ ♂ et 3 ♀ ♀. S-222: 28-II-1992, 1 ♂ et 1 ♀. S-223: 13-IV-1989, 4 ♂ ♂ et 5 ♀ ♀. S-234: 18-VI-1998, 1 ♂. S-235: 12-VII-1991, 1 ♂. S-249: 7-X-1991, 9 ♂ ♂ et 9 ♀ ♀. S-253: 20-X-1997, 1 ♂. S-255: 23-III-1997, 1 ♂. S-262: 27-IX-1993, 5 ♂ ♂ et 15 ♀ ♀. S-264: 23-III-1997, 1 ♀. S-267: 8-VI-1991, 1 ♀. S-268: 8-VI-1991, 3 ♂ ♂ et 1 ♀. S-269: 28-VI-1999, 2 ♀ ♀.

Espèce Ouest-Paléarctique-Ethiopienne, signalée au Maroc dans la Meseta côtière (El Alaoui, 1985) et plus précisément à Rabat (Bedel, 1925), Bouznika (Kocher, 1958), et Casablanca (Escalera, 1914; Bedel, 1925; Kocher, 1958), au Maroc oriental (Chavanon et al., 2004), dans la vallée de la Moulouya (Alluaud, 1926; Berrahou et al., 2000) et à Oujda (Berrahou et al., 2000), au Moyen Atlas: aux environs d'Azrou (Lindberg, 1939), dans le Haut Atlas, aux environs de Marrakech (Lindberg, 1939; Guignot, 1946; Kocher, 1958; Mezdi & Giudicelli, 1986; Bouzidi, 1989; Ajakane, 1998) et de Ouarzazate (Bedel, 1925; Kocher, 1949) et enfin dans les environs de Tata dans l'Anti Atlas (Kocher & Reymond, 1954). Dans le Rif, elle a été mentionnée à Tanger (Bedel, 1925; Lindberg, 1939), à Tétouan, à Chefchaouen (Bennas et al., 1992) et à Nador (Chavanon et al., 2004). Nos récoltes nous ont permis de la signaler pour la première fois à Larache et Al Hoceima.

*Peltodytes caesus* (Duftschmid, 1805)

MATÉRIEL ÉTUDIÉ. Tanger. S-174: 2-VII-1995, 1 ♂. Tetouan. S-215: 28-II-1992, 1 ♂.

Espèce de distribution Centroasiatique-Européenne avec extension au Maroc, dans ce dernier pays, elle a été répertoriée depuis le début du XX<sup>e</sup> siècle (Escalera, 1914). Plus tard, d'autres localités sont venues enrichir l'aire de distribution de ce *Peltodytes* Régimbart, 1879: la région de Oujda (Bedel, 1925; Kocher, 1958; Chavanon et al., 2004) au Maroc oriental, la Meseta côtière (Lindberg, 1939; Kocher, 1958; El Alaoui, 1983, 1985) sur le littoral atlantique, les environs d'Azrou (Lindberg, 1939) au Moyen Atlas et en fin la région de Marrakech (Bouzidi, 1989) dans le Haut Atlas. Au Rif, cette espèce n'est connue que de Tanger (Bedel, 1925; Alluaud, 1926; Lindberg, 1939; Kocher, 1958; Vondel, 1992) et de Tétouan (Bennas, 1987, 1990; Bennas et al., 1992). Nous l'avons effectivement capturé dans les mêmes provinces.



*Peltodytes rotundatus* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-39: 9-VI-1991, 1 ♂ et 3 ♀ ♀. S-54: 17-IV-1997, 3 ♂ ♂ et 2 ♀ ♀. S-57: 20-VII-1998, 2 ♂ ♂. Larache. S-116: 10-VII-1991, 2 ♂ ♂ et 3 ♀ ♀. S-117: 8-V-1997, 1 ♂ et 2 ♀ ♀. Tanger. S-170: 6-X-1991, 1 ♀. S-173: 8-V-1997, 1 ♂. S-183: 18-VI-1998, 1 ♂. Taounate. S-196: 5-VI-1999, 1 ♂. Tetouan. S-235: 12-VII-1991, 1 ♀. S-240: 23-III-1997, 1 ♂ et 1 ♀. S-242: 9-VII-1991, 1 ♀. S-243: 8-V-1993, 5 ♀ ♀. S-244: 23-III-1997, 1 ♂. S-249: 7-X-1991, 1 ♀. S-253: 20-X-1997, 1 ♀. S-262: 27-IX-1993, 1 ♀.

Espèce de diffusion Sud-Européenne avec une extension en Turquie, en Tunisie et au Maroc. Dans ce dernier pays, elle a été citée de plusieurs localités dispersées dans l'ensemble du pays. Elle a en effet été signalée dans sa partie Nord orientale à Oujda et Figuig (Bedel, 1925; Vondel, 1992; Chavanon et al., 2004), sur sa façade atlantique: depuis Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939) à Essaouira (Escalera, 1914) en passant par la frange littorale entre Kénitra (Bedel, 1925) et Casablanca (El Alaoui, 1985), au centre, aux environs de Fès au Moyen Atlas (Lindberg, 1939), au Sud, dans les environs de Marrakech (Lindberg, 1939; Ajakane, 1998) et de Tamanar (Vondel, 1992) dans le Haut Atlas et à Tiznit dans l'Anti Atlas. Dans le Rif, en plus de Tanger, elle est mentionnée de deux localités une occidentale Bab Berret à Chefchaouen (Bennas, 1990) et la deuxième méridionale Fès el Bali à Taounate (Kocher, 1938). Nos prospections ont permis d'enrichir son aire de distribution de 17 localités nouvelles desquelles 10 s'avèrent des nouvelles citations pour les provinces de Tétouan et de Larache.

## Noteridae

*Canthydrus diophthalmus* (Reiche & Saulcy, 1855)

Espèce de distribution Méditerranéenne. Au Maroc, l'espèce est connue par trois mentions très anciennes se rapportant à trois localités dont une rifaine: Tanger (Escalera, 1914) au Nord, Mechrae Bel Ksiri et Casablanca (Bedel, 1925) à l'Ouest. Les trois citations sont reprises dans le catalogue de Kocher (1958). Depuis, deux nouvelles citations sont venues corroborer la présence de cette espèce au Maroc: la Meseta côtière (El Alaoui, 1985) et le Maroc oriental (Chavanon et al., 2004).

*Noterus laevis* Sturm, 1834

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-39: 9-VI-1991, 1 ♂. S-64: 24-III-1996, 1 ♂. S-102: 4-VI-1992, 1 ♀. Tetouan. S-215: 28-II-1992, 34 ♂ ♂ et 12 ♀ ♀, 8-I-1989, 22 ♂ ♂ et 20 ♀ ♀, 21-I-1989, 1 ♂. S-221: 13-IV-1987, 2 ♂ ♂ et 3 ♀ ♀. S-222: 28-II-1992, 3 ♂ ♂ et 2 ♀ ♀, 8-I-1987, 2 ♂ ♂ et 4 ♀ ♀, 22-III-1988, 3 ♀ ♀, 7-VI-1988, 5 ♂ ♂ et 20 ♀ ♀, 22-II-1989, 33 ♂ ♂ et 101 ♀ ♀, 1-IV-1989, 2 ♂ ♂ et 2 ♀ ♀, 19-VII-1989, 1 ♀. S-223: 13-IV-1989, 13 ♂ ♂ et 3 ♀ ♀, 22-VII-87, 8 ♂ ♂ et 7 ♀ ♀, 2-I-1989, 46 ♂ ♂ et 89 ♀ ♀, 13-IV-1989, 1 ♂ et 1 ♀, 17-VI-1989, 6 ♂ ♂ et 12 ♀ ♀, 22-VIII-1989, 6 ♂ ♂ et 6 ♀ ♀. S-227: 9-VI-1991, 1 ♂ et 2 ♀ ♀.

Espèce de diffusion Ouest-Méditerranéenne, signalée au Maroc sur le littoral atlantique, entre Kénitra et Casablanca (El Alaoui, 1985) et à Essaouira (Kocher, 1958), dans le Haut Atlas à Marrakech (Escalera, 1914; Bedel, 1925; Bouzidi, 1989), dans le Moyen Atlas à Timahdit (Kocher, 1958) et enfin dans le Rif à Tanger (Escalera, 1914; Bedel, 1925), à Tétouan (Bennas, 1987, 1990), à Chefchaouen (Bennas, 1990) et à Nador (Chavanon et al., 2004).



## Hygrobiidae

*Hygrobia hermanni* (Fabricius, 1775)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-105: 11-VII-1991, 2 ♂♂. S-106: 11-VII-1991, 3 ♂♂ et 2 ♀♀. Tanger. S-170: 6-X-1991, 1 ♀.

Espèce de diffusion Méditerranéenne avec un prolongement en Europe Atlantique. Au Maroc, elle est signalée sur le frange côtière atlantique depuis Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958) jusqu'à Essaouira (Escalera, 1914; Bedel, 1925) en passant par Kénitra, Rabat et Casablanca (Bedel, 1925; Lindberg, 1939; Kocher, 1958; El Alaoui, 1985), dans le Moyen Atlas (Escalera, 1914) à Aguelmane (Kocher, 1958) et dans le Haut Atlas (Bouzidi, 1989) à Marrakech. Dans le Rif, en plus de Tanger, elle a été répertoriée dans la province de Chefchaouen (Bennas, 1990).

## Dytiscidae

*Agabus (Gaurodytes) biguttatus* (Olivier, 1795)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 7 ♂♂ et 6 ♀♀. S-19: 22-VI-1998, 1 ♀. S-23: 22-VI-1998, 1 ♀. S-25: 22-VI-1998, 3 ♂♂ et 8 ♀♀. S-26: 22-VI-1998, 6 ♂♂ et 6 ♀♀. S-27: 22-VI-1998, 3 ♂♂ et 5 ♀♀. S-30: 5-VI-1992, 2 ♂♂ et 2 ♀♀. S-31: 29-IX-1993, 1 ♂. Chefchaouen. S-84: 10-VI-1991, 1 ♂ et 2 ♀♀. S-92: 4-VI-1992, 3 ♂♂ et 7 ♀♀. S-101: 22-VI-1998, 1 ♂. S-103: 13-IV-1999, 1 ♂. S-109: 22-VI-1998, 5 ♀♀. S-112: 28-IX-1993, 1 ♀. Larache. S-132: 28-VI-1999, 1 ♂ et 3 ♀♀. S-134: 28-VI-1999, 1 ♀. S-136: 28-VI-1999, 1 ♂ et 1 ♀. Nador. S-160: 13-VI-1991, 2 ♂♂. Taza. S-203: 13-VI-1991, 1 ♂ et 4 ♀♀. S-208: 13-VI-1991, 1 ♂ et 5 ♀♀.

Espèce de distribution Paléarctique en excluant une grande partie de la Sibérie et du Japon. Au Maroc, elle a été citée dans le Haut Atlas (Kocher, 1938, 1949, 1958; Guignot, 1946) et dans les environs de Fès (Kocher, 1938, 1958; El Alaoui, 1985) et d'Azrou (Bedel, 1925) au Moyen Atlas. Dans le Rif, les références bibliographiques consultées n'ont pas apporté de citations concrètes appartenant au domaine rifain, ce qui fait de nos captures dans les provinces d'Al Hoceima, de Larache, de Chefchaouen, de Nador et de Taza les premières dans cette contrée du pays.

*Agabus (Gaurodytes) bipustulatus* (Linnaeus, 1767)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-64: 24-III-1996, 1 ♂. S-99: 11-VII-1991, 2 ♂♂ et 1 ♀. S-102: 4-VI-1992, 1 ♀. S-104: 11-VII-1991, 1 ♀. S-107: 15-VI-1991, 3 ♂♂ et 3 ♀♀. S-109: 22-VI-1998, 1 ♂ et 2 ♀♀. S-112: 28-IX-1993, 1 ♀. Larache. S-132: 28-VI-1999, 1 ♂ et 3 ♀♀. S-134: 28-VI-1999, 2 ♂♂ et 1 ♀. Tetouan. S-223: 13-IV-1989, 1 ♂.

Espèce de distribution Paléarctique en excluant une grande partie de la Sibérie et du Japon. Au Maroc, elle est connue sur sa façade atlantique entre Kénitra et Casablanca (Lindberg, 1939; El Alaoui, 1985), dans le Moyen Atlas à Fès (Lindberg, 1939) et dans le Haut Atlas aux environs de Marrakech (Guignot, 1946; Kocher, 1958) et de Bou Arfa (Alluaud, 1926). Au Nord du pays, elle a été mentionnée dans le Prérif à Taza (Kocher, 1938) et dans le Rif à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939), à Tétouan



(Bennas, 1987) et à Chefchaouen (Bennas, 1990). Nous la signalons pour la première fois dans la province de Larache.

*Agabus (Gaurodytes) brunneus* (Fabricius, 1798)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 1 ♀. S-19: 22-VI-1998, 1 ♂ et 2 ♀ ♀. S-25: 22-VI-1998, 1 ♀. S-27: 22-VI-1998, 1 ♀. Chefchaouen. S-61: 24-IV-1995, 1 ♂. S-64: 24-III-1996, 1 ♀. S-80: 30-IV-1997, 1 ♂ et 2 ♀ ♀. S-90: 4-VI-1992, 1 ♀. S-91: 22-VI-1998, 1 ♀. S-92: 4-VI-1992, 1 ♀. S-94: 3-VI-1992, 2 ♂ ♂. S-95: 4-VI-1992, 1 ♂. S-99: 11-VII-1991, 5 ♂ ♂ et 1 ♀. S-100: 11-VII-1991, 1 ♀. S-109: 22-VI-1998, 1 ♀. Tanger. S-175: 7-III-1999, 1 ♀. Taounate. S-200: 23-VII-1999, 2 ♂ ♂ et 1 ♀. Tetouan. S-239: 23-III-1997, 1 ♀. S-241: 9-VII-1991, 1 ♀. S-249: 7-X-1991, 1 ♂. S-255: 23-III-1997, 1 ♀. S-261: 23-III-1997, 4 ♀ ♀.

Espèce Ouest-Méditerranéenne avec un prolongement en Europe Atlantique et en Syrie. Au Maroc, elle est connue dans sa partie orientale à Oujda (Bedel, 1925) et Jerrada (Alluaud, 1926), au Moyen Atlas, dans les environs d'Azrou (Bedel, 1925; Lindberg, 1939), de Fès (Lindberg, 1939) et de Béni Mellal (Kocher, 1938, 1958), dans le Haut Atlas aux environs de Marrakech (Kocher, 1938; Lindberg, 1939; Kocher, 1949, 1958; Mohati, 1985; Bouzidi, 1989; Ajakane, 1998) et sur la côte atlantique à Essaouira au Sud (Bedel, 1925) et Tanger au Nord (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Millán & Ribera, 2001). Dans le Rif, en plus de Tanger elle a été répertoriée à Ceuta (Lagar Mascaró, 1946). Nous la signalons pour la première fois à Al Hoceima, à Chefchaouen, à Taounate et à Tétouan.

N.B. Après la description de sa congénère *Agabus ramblae* Millán & Ribera, 2001 la révision du matériel marocain s'impose.

*Agabus (Gaurodytes) didymus* (Olivier, 1795)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-19: 22-VI-1998, 2 ♂ ♂ et 3 ♀ ♀. S-24: 4-VI-1992, 4 ♀ ♀. Chefchaouen. S-34: 7-V-1993, 1 ♀. S-54: 17-IV-1997, 1 ♂. S-61: 24-IV-1995, 2 ♀ ♀. S-73: 30-IV-1997, 1 ♂. S-80: 30-IV-1997, 1 ♂ et 2 ♀ ♀. S-89: 13-IV-1999, 1 ♀. S-90: 4-VI-1992, 4 ♂ ♂ et 1 ♀. S-92: 4-VI-1992, 3 ♂ ♂ et 5 ♀ ♀. S-96: 13-IV-1999, 1 ♀. S-99: 11-VII-1991, 2 ♀ ♀. S-109: 22-VI-1998, 1 ♀. Larache. S-128: 21-III-1997, 4 ♂ ♂ et 6 ♀ ♀. S-131: 19-III-1999, 2 ♂ ♂. Nador. S-147: 11-VI-1991, 1 ♂. Tanger. S-181: 8-V-1997, 3 ♂ ♂. Taza. S-203: 13-VI-1991, 2 ♂ ♂ et 4 ♀ ♀. Tetouan. S-216: 7-V-1993, 1 ♀. S-223: 13-IV-1989, 2 ♀ ♀. S-238: 21-III-1997, 1 ♀. S-239: 23-III-1997, 1 ♀. S-254: 9-VI-1991, 1 ♀.

Espèce de distribution Euro-Méditerranéenne. Au Maroc, elle se répartie sur le littoral atlantique entre Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939) et Bouknika (El Alaoui, 1985) en passant par Larache (Escalera, 1914; Bedel, 1925) et Rabat (Bedel, 1925), dans sa partie Nord orientale à Oujda (Berrahou, 1995; Chavanon et al., 2004), dans le Moyen Atlas, elle est signalée dans quatre localités: Fès (Lindberg, 1939), Azrou (Bedel, 1925; Lindberg, 1939), Ifrane (Kocher, 1938, 1958) et El Hajeb (Kocher, 1938), dans le Haut Atlas, elle est mentionnée dans les environs de Marrakech (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958; Bouzidi, 1989). Tanger et Larache, sont donc les seules localités rifaines touchées par ces citations bibliographiques. Nos récoltes ont permis de la recenser pour la première fois à Al Hoceima, à Chefchaouen, à Nador, à Taza et à Tétouan.



*Agabus (Gaurodytes) dilatatus* (Brullé, 1832)

Elément Turanique-Européo-Méditerranéen. L'espèce est connue au Maroc para la seule citation de Jbel Tidghine à Kétama (province d'Al Hoceima) (Guignot, 1946; Kocher, 1969). Malheureusement, durant nos prospections nous n'avons pas pu l'a capturée. *Agabus (Gaurodytes) nebulosus* (Forster, 1771)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 1 ♂ et 1 ♀. S-23: 22-VI-1998, 1 ♂ et 1 ♀. S-25: 22-VI-1998, 1 ♂ et 2 ♀ ♀. S-26: 22-VI-1998, 1 ♀. S-27: 22-VI-1998, 1 ♀. S-28: 29-IX-1993, 1 ♂ et 1 ♀. S-29: 29-IX-1993, 1 ♀. Chefchaouen. S-61: 24-IV-1995, 1 ♂. S-84: 10-VI-1991, 16 ♂ ♂ et 19 ♀ ♀. S-92: 4-VI-1992, 4 ♂ ♂ et 2 ♀ ♀. S-96: 13-IV-1999, 1 ♂ et 2 ♀ ♀. S-102: 4-VI-1992, 1 ♂. S-103: 13-IV-1999, 1 ♀. S-107: 15-VI-1991, 2 ♀ ♀. S-109: 22-VI-1998, 1 ♂ et 1 ♀. Larache. S-128: 21-III-1997, 1 ♂. Nador. S-158: 12-VI-1991, 1 ♂. S-160: 13-VI-1991, 2 ♂ ♂ et 3 ♀ ♀. S-161: 12-VI-1991, 1 ♀. Tetouan. S-224: 6-V-1993, 2 ♂ ♂. S-239: 23-III-1997, 3 ♂ ♂ et 2 ♀ ♀. S-255: 23-III-1997, 1 ♀.

Espèce de diffusion Turanique-Européo-Méditerranéenne, sa présence au Maroc a été décelée depuis le début du siècle mais sans localité précise (Escalera, 1914). Depuis, plusieurs localités sont venues enrichir son aire de distribution marocain, ainsi dans sa partie Nord orientale, elle a été citée à Oujda (Bedel, 1925; Berrahou, 1995; Berrahou et al., 2001; Chavanon et al., 2004) et à Jerada (Alluaud, 1926; Chavanon et al., 200). Sur le littoral atlantique, elle est mentionnée entre Kénitra et Casablanca (El Alaoui, 1985) et à Essaouira (Bedel, 1925), au Moyen Atlas à Azrou (Kocher, 1958) et enfin dans le Haut Atlas à Ouarzazate (Bedel, 1925), à Errachidia (Kocher, 1958) et à Marrakech (Lindberg, 1939). Dans le Rif, elle a été mentionnée à Tanger (Lindberg, 1939; Kocher, 1958), à Tétouan (Kocher, 1958; Bennas, 1987) et à Nador (Chavanon et al., 2004). Nous la signalons pour la première à Al Hoceima, à Chefchaouen et à Larache.

*Ilybius chalconatus* (Panzer, 1797)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-102: 4-VI-1992, 3 ♂ ♂ et 3 ♀ ♀. Larache. S-131: 19-III-1999, 1 ♂. Taounate. S-200: 23-VII-1999, 1 ♂. Tetouan. S-237: 21-III-1997, 1 ♂.

Espèce de distribution Turanique-Européenne avec une extension en Algérie et au Maroc Dans ce dernier pays elle n'est connue que par sept citations dont une douteuse. Deux touchent le Moyen Atlas: Azrou (Bedel, 1925; Kocher, 1958) et Ifrane (Kocher, 1958; Fery & Nilsson, 1993), une le Haut Atlas: les environs de Marrakech (Mohati, 1985; Bouzidi, 1989; Ajakane, 1998), et une l'Anti Atlas (Ribera et al., 2001). La cinquième concerne le littoral atlantique au Sud de Bouznika (El Alaoui, 1985), la sixième à Oujda (Chavanon et al., 2004) au Maroc oriental et enfin la septième rifaine à Tanger (Escalera, 1914; Bedel, 1925). Toutefois cette citation à été remise en cause par Kocher (1958) stipulant qu'ils se référaient probablement à *I. montanus* (Stephens, 1828). Durant nos prospections, nous avons repéré cette espèce dans quatre localités qui s'avèrent être le premier enregistrement pour les catalogues de quatre provinces rifaines: Chefchaouen, Larache, Taounate et Tétouan.

*Ilybius meridionalis* (Fabricius, 1792)

Elément Ouest-Méditerranéen. Au Maroc, l'espèce est connue dans trois régions, le



plateau central (El Alaoui, 1985), le Moyen Atlas à Timahdit (Bedel, 1925 ; Kocher, 1958; El Alaoui, 1985) et le Rif à Tétouan (Bennas, 1987).

*Ilybius montanus* (Stephens, 1828)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-107: 15-VI-1991, 1 ♂.

Elément Européen avec une extension en Algérie et au Maroc. Dans ce dernier pays, les sources bibliographiques consultées n'ont fourni qu'une seule localité de capture située aux environs de Casablanca (Kocher, 1958) où elle a été citée comme *Agabus melanocornis* Zimmermann, 1915. Durant nos prospections dans le Rif, un individu appartenant à cette espèce a été capturé pour la première fois, dans une seule localité de la province de Chefchaouen. Avec cette capture, la présence de l'espèce se confirme donc au Maroc.

*Colymbetes fuscus* (Linnaeus, 1758)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-99: 11-VII-1991, 1 ♂ et 1 ♀. S-104: 11-VII-1991, 1 ♂ et 3 ♀ ♀. S-105: 11-VII-1991, 2 ♀ ♀. Nador. S-160: 13-VI-1991, 1 ♂.

Espèce de diffusion Centroasiatique-Européo-Méditerranéenne. Après la découverte de sa congénère *C. schildknehti* Dettner, 1983, et la révision du matériel de cette espèce provenant de plusieurs localités marocaines, certaines citations de *C. fuscus* ont passé à *C. schildknehti*. Par ailleurs, les citations qui n'ont pas été corrigées et nécessitent une révision sont celles de Kénitra, de Casablanca (Bedel, 1925; Kocher, 1938; El Alaoui, 1985), de Marrakech (Kocher, 1958), d'Azrou (Kocher, 1938), de Oujda (Berrahou, 1995; Chavanon et al., 2004) et de Ceuta (Lagar Mascaró, 1946). Dans le Rif, cette espèce a été signalée à Tétouan (Bennas, 1987) et nous l'avons capturé pour la première fois à Chefchaouen et à Nador.

*Colymbetes schildknehti* Dettner, 1983

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-63: 30-X-1998, 1 ♂. Nador. S-147: 11-VI-1991, 1 ♂. Tetouan. S-239: 23-III-1997, 1 ♂ et 2 ♀ ♀.

Espèce de distribution Ouest-Méditerranéenne, connue au Maroc de plusieurs localités dont les plus anciennes étaient attribuées à *C. fuscus*. Ainsi, dans le littoral atlantique elle est signalée dans la région du Gharb (Lindberg, 1939), à Rabat, Kénitra et Benslimane (Balke et al., 1990), au Moyen Atlas à Azrou (Bedel, 1925; Lindberg, 1939) et à Ifrane (Lindberg, 1939) et enfin au Rif à Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958; Balke et al., 1990) et à Tétouan (Balke et al., 1990). Nous la signalons pour la première fois à Chefchaouen et à Nador.

*Meladema coriacea* Laporte de Castelnau, 1835

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-91: 22-VI-1998, 1 ♀. S-99: 11-VII-1991, 2 ♂ ♂ et 1 ♀. Larache. S-124: 11-XI-1997, 1 ♀. S-128: 21-III-1997, 1 ♀. Tetouan. S-241: 9-VII-1991, 1 ♀.

Elément Méditerranéen avec une extension dans les îles Canaries. Au Maroc, l'espèce est connue de plusieurs localités bien dispersées. À l'Est elle est signalée à Oujda (Escalera, 1914; Bedel, 1925; Kocher, 1954; Chavanon et al., 2004), sur le littoral atlantique.



tique à Al Jadida (Kocher, 1938) et entre Kénitra et Casablanca (El Alaoui, 1985), au Moyen Atlas à Azrou, à Ifrane (Lindberg, 1939) et à Méknes (Kocher, 1958), dans le Haut Atlas aux environs de Marrakech (Bouzidi, 1989; Ajakane, 1998), dans l'Anti Atlas au Sud de Ouarzazate (Kocher, 1949, 1958; Ribera et al., 2003), au Nord de Zagora (Guignot, 1946) et entre Errachidia et Bouarfa (Kocher & Reymond, 1954), et enfin dans le Prérif, au sud de Taza (Escalera, 1914; Bedel, 1925; Kocher, 1954) et dans le parc de Tazekka (Ribera et al., 2003). Dans le Rif, elle a été recensée à Ceuta (Lagar Mascaró, 1945, 1946) et à Nador (Chavanon et al., 2004). Nous la signalons pour la première fois à Chefchaouen, à Larache et à Tétouan.

*Rhantus (Rhantus) suturalis* (McLeay, 1825)

MATÉRIEL ÉTUDIÉ. Tetouan. S-221: 13-IV-1987, 1 ♂. S-222: 28-II-1992, 1 ♀. S-227: 9-VI-1991, 1 ♂.

Elément Subcosmopolite. Au Maroc, l'espèce est citée sur le littoral atlantique, dans la Meseta côtière (El Alaoui, 1985), et aux environs d'Agadir (Kocher, 1958, 1964) et dans le Rif à Ceuta (Lagar Mascaró, 1946) et à Tétouan (Bennas, 1987, 1990).

*Copelatus atriceps* (Sharp, 1882)

Espèce de diffusion Ouest-Méditerranéenne, citée au Maroc sur le littoral atlantique dans la Meseta côtière (Bedel, 1925; Lindberg, 1939; El Alaoui, 1985) et à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958) et dans le Moyen Atlas à Méknes (Bedel, 1925). Cette espèce n'a pu être retrouvée durant nos prospections.

*Acilius (Homoelytrus) duvergeri* Gobert, 1874

Elément Ouest-Méditerranéen. Au Maroc, l'espèce est connue à partir de deux citations qui remontent au début du siècle, Rabat (Bedel, 1925) et Tanger (Escalera, 1914; Bedel, 1925). Les deux citations sont reprises dans le catalogue de Kocher (1958). Depuis, cette espèce n'a nulle part été retrouvée.

*Cybister (Cybister) tripunctatus africanus* Laporte de Castelnau, 1834

Sous espèce de diffusion Afrotropicale-Méditerranéenne, au Maroc elle est connue dans la région du Gharb (Lindberg, 1939), à Tanger et à Essaouira (Escalera, 1914; Bedel, 1925; Kocher, 1958), à Settat (Escalera, 1914; Bedel, 1925; Kocher 1969), aux environs de Meknés (Kocher, 1969) et à Chefchaouen (Bedel, 1925). Espèce non localisée durant nos prospections.

*Cybister (Melanectes) vulneratus* Klug, 1834

Elément Afrotropicale-Méditerranéenne. Les source bibliographiques consultées n'ont fourni que deux citations concrètes: la région du Gharb (Lindberg, 1939) et Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958) au Rif.

*Cybister (Scaphinectes) lateralimarginalis lateralimarginalis* (De Geer, 1774)



MATÉRIEL ÉTUDIÉ. Al Hoceima. S-24: 4-VI-1992, 1 ♂. Tetouan. S-218: 6-V-1993, 1 ♂.

Sous espèce de diffusion Turanique-Européo-Méditerranéen. Au Maroc, elle est connue à Rabat (Bedel, 1925; Kocher, 1958) et à Bouznika (Kocher, 1969; El Alaoui, 1985) sur le littoral atlantique. Au centre du pays à Settat (Bedel, 1925), au Moyen Atlas au Sud d'Azrou (Kocher, 1958) et au Maroc oriental à Oujda (Lindberg, 1939). Dans le Rif, elle a été signalée à Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958) et à Tétouan (Bennas, 1990). Nous la signalons pour la première fois à Al Hoceima.

### *Dytiscus circumflexus* Fabricius, 1801

Elément Turanique-Européo-Méditerranéen. Au Maroc, l'espèce est mentionnée sur le littoral atlantique à Rabat (Bedel, 1925) et à Essaouira (Escalera, 1914; Bedel, 1925; Kocher, 1958), au centre à Souk l'Arbae (Bedel, 1925) et à Settat (Escalera, 1914), au Moyen Atlas à Azrou (Lindberg, 1939; Kocher, 1958) et au Maroc oriental à Oujda (Chavanon et al., 2004). Dans le Rif, elle est citée à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958) et à Nador (Chavanon et al., 2004).

N.B. La localité appelée Jbel Amisitten citée par Lindberg (1939) n'a pu être localisée.

### *Dytiscus pisanus* Laporte de Castelnau, 1834

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-96: 13-IV-1999, 1 ♀. Larache. S-131: 19-III-1999, 1 ♂.

Espèce de distribution Ouest-Méditerranéenne. Bien qu'elle soit qualifiée de rare au Maroc (Guignot, 1946), l'espèce est signalée dans les trois domaines de l'Atlas marocain: au Moyen Atlas aux environs d'Azrou (Bedel, 1925; Lindberg, 1939, Kocher, 1969), dans le Haut Atlas aux environs de Marrakech (Kocher, 1949, 1958, 1969) et dans l'Anti Atlas au Sud de Ouarzazate (Guignot, 1946; Kocher, 1958). Dans le Prérif elle est mentionnée à Taza (Kocher, 1958) et sur le littoral atlantique, à Rabat (Kocher, 1958) et à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958). Dans le Rif, en plus de Tanger nous la signalons pour la première fois à Chefchaouen et à Larache.

### *Eretes sticticus* (Linnaeus, 1767)

MATÉRIEL ÉTUDIÉ. Nador. S-151: 11-X-1991, 3 ♀ ♀.

Malgré le caractère Subcosmopolite de cette espèce, elle n'est connue au Maroc qu'au Moyen Atlas aux environs de Fès (Bedel, 1925) et de Midelt (Kocher, 1958), au Maroc oriental à Oujda et à Figuig (Chavanon et al., 2004), dans l'Anti Atlas, au Sud d'Errachidia (Kocher & Reymond, 1954). Sa distribution se continue dans le domaine saharien (Peyerimhoff, 1944) au Sud. Dans le Rif, elle a été citée à Tanger (Escalera, 1914; Bedel, 1925), à Tétouan (Bennas, 1987, 1990) et à Nador (Chavanon et al., 2004). Nous l'avons effectivement localisée dans cette dernière province.

N.B. Après la parution du travail de Miller (2002) la révision du matériel marocain s'impose, étant donné que sa congénère *Eretes griseus* (Fabricius, 1781) est également citée au Maroc (Miller, 2002).



*Hydaticus (Guignotites) leander* (Rossi, 1790)

MATÉRIEL ÉTUDIÉ. Tanger. S-174: 2-VII-1995, 3 ♂♂ et 1 ♀. Tetouan. S-222: 28-II-1992, 2 ♂♂ et 1 ♀. S-223: 13-IV-1989, 3 ♀♀. S-256: 24-IV-1995, 1 ♂.

Espèce de diffusion Afrotropicale-Méditerranéenne, n'est connue au Maroc que de trois localités: Rabat (Bedel, 1925; Kocher, 1958) et Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958) sur le littoral atlantique et Tétouan (Bennas, 1987) sur la frange méditerranéenne. C'est effectivement, dans les mêmes provinces où des populations de cette espèce ont été localisées.

*Bidessus coxalis* Sharp, 1882

Espèce de diffusion Ouest-Méditerranéenne, connue au Maroc dans quatre localités, Figuig (Chavanon et al., 2004) au Maroc oriental, Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958; Fery, 1991) et Larache (Kocher, 1958) au Rif. La quatrième localité correspond à Lalla Mimouna (Lindberg, 1939). Le même nom est donné à quatre régions différentes du pays, par conséquent on n'a pas pu savoir à quelles des quatre correspond la citation de Lindberg (1939). Malgré les nombreuses prospections cette espèce est restée introuvable.

*Bidessus goudoti* (Laporte de Castelnau, 1834)

Espèce de diffusion Ouest-Méditerranéenne. Au Maroc, elle est connue sur la façade atlantique du pays, dans la Meseta côtière entre Kénitra et Casablanca (Bedel, 1925; Lindberg, 1939; Kocher, 1958; El Alaoui, 1983, 1985), au Moyen Atlas à Timahdit (Kocher, 1958) et dans le Rif à Tanger (Escalera, 1914; Kocher, 1958) et à Chefchaouen (Bedel, 1925). La localité Lalla Mimouna (Lindberg, 1939) est également mentionnée pour cette espèce. Tous les efforts déployés pour retrouver cette espèce ont été vains.

*Bidessus minutissimus* (Germar, 1824)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-11: 16-III-1998, 2 ♂♂. S-16: 22-VI-1998, 1 ♂. S-18: 10-VI-1991, 4 ♂♂ et 7 ♀♀. Chefchaouen. S-43: 28-VIII-1994, 1 ♀. S-48: 28-VIII-1994, 1 ♀. S-57: 20-VII-1998, 1 ♀. S-61: 24-IV-1995, 1 ♂. S-71: 4-VI-1992, 2 ♀♀. S-73: 30-IV-1997, 1 ♀. S-76: 20-VII-1998, 3 ♂♂ et 4 ♀♀. S-80: 30-IV-1997, 1 ♂. S-82: 22-VIII-1999, 2 ♀♀. S-90: 4-VI-1992, 4 ♂♂ et 6 ♀♀. S-91: 22-VI-1998, 1 ♀. S-95: 4-VI-1992, 1 ♀. Larache. S-116: 10-VII-1991, 1 ♂ et 2 ♀♀. S-119: 24-VI-1998, 1 ♂. S-121: 10-VII-1991, 1 ♀. S-127: 21-III-1997, 1 ♂ et 3 ♀♀. S-131: 19-III-1999, 1 ♂ et 1 ♀. Nador. S-157: 12-VI-1991, 1 ♂ et 1 ♀. S-160: 13-VI-1991, 5 ♂♂ et 15 ♀♀. Sidi Kacem. S-165: 22-VII-1999, 1 ♀. Tanger. S-172: 9-VII-1991, 1 ♂. S-176: 10-VII-1991, 1 ♀. S-186: 8-V-1997, 1 ♀. Taounate. S-193: 6-VI-1999, 1 ♂. S-195: 5-VI-1999, 2 ♂♂. S-197: 4-VI-1992, 1 ♀. Taza. S-202: 5-VI-1999, 2 ♀♀. S-213: 5-VI-1999, 3 ♀♀. Tetouan. S-228: 8-V-1993, 1 ♂. S-230: 8-V-1998, 1 ♂. S-232: 12-VII-1991, 6 ♂♂ et 7 ♀♀. S-235: 12-VII-1991, 1 ♂ et 1 ♀. S-238: 21-III-1997, 2 ♂♂ et 10 ♀♀. S-240: 23-III-1997, 1 ♂. S-241: 9-VII-1991, 1 ♀. S-251: 24-III-1996, 1 ♀. S-253: 20-X-1997, 1 ♂. S-266: 24-IV-1995, 2 ♀♀. S-268: 8-VI-1991, 1 ♂ et 1 ♀. S-269: 28-VI-1999, 12 ♂♂ et 28 ♀♀.

Espèce de diffusion Ouest méditerranéenne, avec une extension dans le domaine At-



lantique (depuis les îles Canaries jusqu'aux îles Britanniques). Sa distribution se continue de manière discontinue sous forme de populations isolées au Sud de l'Europe centrale. Elle est largement répandue dans la majorité des domaines marocains. Ainsi, dans sa partie orientale, elle a été citée à Oujda (Kocher, 1958; Berrahou, 1995, Berrahou et al., 2001), Figuig et à Berkane (Chavanon et al., 2004), sur sa frange côtière atlantique elle est mentionnée entre Kénitra et Casablanca (Reymond, 1951; El Alaoui, 1985). Au Prérif, elle a été recensée à Sidi Kacem (Reymond, 1951). Au Moyen Atlas elle est signalée à Fès (Kocher, 1958) et à Béni Mellal (Fery, 1991). Dans le Plateau central elle est citée à Khouribga (Fery, 1991), au Sud du pays elle est signalée à Sidi Ifni (Kocher, 1958), à Goulmime (Peyrimhoff, 1944), à Marrakech (Panouse, 1963; Bouzidi, 1989; Ajakane, 1998) et à Ouarzazate (Kocher, 1949, 1958; Fery, 1991). Dans le Rif, cette espèce a été citée à Larache par Bedel (1925) laquelle a été remise en cause par Kocher (1958) qui l'a qualifiée de douteuse. La capture de cette espèce dans toutes les provinces rifaines montre que son aire de distribution couvre également le Nord du pays.

*Hydroglyphus geminus* (Fabricius, 1792)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-2: 11-VI-1991, 2 ♂♂ et 1 ♀. S-11: 16-III-1998, 1 ♂ et 1 ♀. Chefchaouen. S-63: 30-X-1998, 1 ♂. S-82: 22-VIII-1999, 1 ♀. S-84: 10-VI-1991, 1 ♂. Larache. S-114: 8-V-1997, 1 ♂. Nador. S-158: 12-VI-1991, 2 ♂♂. S-161: 12-VI-1991, 1 ♂. Sidi Kacem. S-164: 8-X-1991, 6 ♂♂ et 4 ♀♀. Tanger. S-174: 2-VII-1995, 1 ♂. Taounate. S-189: 8-X-1991, 1 ♂. S-193: 6-VI-1999, 1 ♂. S-194: 23-VII-1999, 1 ♀. Tetouan. S-218: 6-V-1993, 1 ♀. S-220: 25-IX-1994, 3 ♂♂ et 2 ♀♀. S-223: 13-IV-1989, 1 ♂. S-227: 9-VI-1991, 15 ♂♂ et 1 ♀. S-234: 18-VI-1998, 1 ♂.

Espèce de distribution Paléarctique avec une légère extension dans la région Orientale, mentionnée au Maroc sur la façade atlantique du pays à Tanger (Escalera, 1914), entre Kénitra et Casablanca (Lindberg, 1939; Guignot, 1959a; El Alaoui, 1983, 1985) et à Essaouira (Escalera, 1914; Bedel, 1925), au Maroc oriental à Oujda et à Figuig (Berrahou et al., 2001; Chavanon et al., 2004), dans le Moyen Atlas à Ifrane et à Fès (Guignot, 1959a), dans le Haut Atlas à Marrakech (Escalera, 1914; Lindberg, 1939; Ajakane, 1998) et dans sa partie Sud-Orientale, aux environs d'Errachidia (Alluaud, 1926) et dans l'Anti Atlas aux environs de Goulmine (Kocher & Reymond, 1954). Dans l'aire d'étude, en plus de Tanger, elle a été recensée à Tétouan, à Chefchaouen (Bennas, 1987, 1990) et à Nador (Chavanon et al., 2004). Nos récoltes nous ont permis de la signaler pour la première à Al Hoceima, à Sidi Kacem et à Taounate.

*Yola bicarinata bicarinata* (Latreille, 1804)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-13: 16-III-1998, 1 ♂. Chefchaouen. S-72: 30-IV-1997, 1 ♂. Larache. S-119: 24-VI-1998, 1 ♂. S-121: 10-VII-1991, 1 ♂. Nador. S-144: 2-X-1993, 3 ♂♂ et 3 ♀♀. Tanger. S-168: 2-VII-1995, 1 ♀. S-170: 6-X-1991, 1 ♀. S-180: 9-VII-1991, 1 ♂. S-186: 8-V-1997, 1 ♂. Taounate. S-193: 6-VI-1999, 1 ♂ et 1 ♀. Taza. S-209: 10-X-1991, 2 ♀♀. Tetouan. S-232: 12-VII-1991, 1 ♀. S-233: 12-VII-1991, 2 ♂♂. S-262: 27-IX-1993, 13 ♂♂ et 6 ♀♀.

Espèce de diffusion Ouest méditerranéenne, avec une extension dans la côte atlantique européenne (Portugal, Belgique et Hollande) en plus de quelques populations isolées



dans la Suède, la Slovène et la république Chèque. Au Maroc, l'espèce s'étend sur la façade atlantique du pays depuis Tanger à Essaouira (Escalera, 1914; Bedel, 1925) en passant par Kénitra et Casablanca (Kocher, 1938; El Alaoui, 1983, 1985), au Maroc oriental à Oujda (Bedel, 1925; Chavanon et al., 2004), à Jerada (Alluaud, 1926) et à Berkane et Figuig (Chavanon et al., 2004), dans le Moyen Atlas à Fès (Bedel, 1925) et dans le Haut Atlas à Marrakech (Biström, 1983; Bouzidi, 1989; Ajakane, 1998). La distribution de l'espèce se continue vers le Sud où elle a été citée à Tiznit et à Tarfaya (Biström, 1983). Dans le Rif, en plus de Tanger (Bedel, 1925; Biström, 1983) elle est signalée à Ceuta (Lagar Mascaró, 1946). Nos prospections ont permis de la localiser dans toutes les provinces rifaines à l'exception de Sidi-Kacem.

### *Deronectes fairmairei* (Leprieur, 1876)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-9: 16-III-1998, 6 ♂♂ et 6 ♀♀. S-10: 16-III-1998, 1 ♂ et 1 ♀. S-11: 16-III-1998, 3 ♂♂ et 15 ♀♀. S-17: 22-VI-1998, 1 ♂. Chefchaouen. S-35: 7-V-1993, 1 ♀. S-38: 10-XI-1997, 2 ♀♀. S-43: 28-VIII-1994, 1 ♂ et 1 ♀. S-54: 17-IV-1997, 1 ♂ et 3 ♀♀. S-59: 15-IV-1998, 2 ♂♂ et 4 ♀♀. S-80: 30-IV-1997, 2 ♂♂ et 2 ♀♀. S-86: 24-IV-1995, 3 ♂♂ et 6 ♀♀. Larache. S-119: 24-VI-1998, 2 ♀♀. S-124: 11-XI-1997, 1 ♂ et 1 ♀. Nador. S-157: 12-VI-1991, 1 ♂. S-160: 13-VI-1991, 6 ♂♂ et 4 ♀♀. Tanger. S-173: 8-V-1997, 1 ♀. S-181: 8-V-1997, 1 ♂ et 1 ♀. S-182: 18-VI-1998, 6 ♂♂ et 6 ♀♀. Tetouan. S-216: 7-V-1993, 10 ♂♂ et 9 ♀♀. S-217: 7-V-1993, 2 ♂♂ et 3 ♀♀. S-223: 13-IV-1989, 1 ♀. S-225: 7-V-1993, 1 ♂ et 2 ♀♀. S-230: 8-V-1998, 5 ♂♂ et 9 ♀♀. S-235: 12-VII-1991, 14 ♂♂ et 15 ♀♀. S-240: 23-III-1997, 3 ♂♂ et 6 ♀♀. S-241: 9-VII-1991, 5 ♂♂ et 5 ♀♀. S-242: 9-VII-1991, 1 ♂ et 1 ♀. S-250: 21-III-1997, 1 ♂. S-266: 24-IV-1995, 3 ♂♂ et 2 ♀♀.

Espèce de distribution Ouest-Méditerranéenne. Au Maroc l'espèce est signalée dans sa partie orientale à Oujda et à Figuig (Berrahou, 1995; Chavanon et al., 2004), dans le Prérif, entre Guercif et Taza (Bertrand, 1938; Kocher, 1954, 1958), dans le Moyen Atlas à Azrou (Lindberg, 1939; Kocher, 1958; Fery & Brancucci, 1997), dans le bassin de Oum-Errabie (Kocher, 1964) et à Khénifra (Fery & Brancucci, 1997), dans le Plateau central à Ben Slimane (Fery & Brancucci, 1997), dans le Haut Atlas, à Marrakech (Lindberg, 1939; Kocher, 1958), à Ouarzazate (Kocher, 1949; Fery & Brancucci, 1997), à Taroudannt (Fery & Brancucci, 1997) et à Gourrama au Nord d'Errachidia (Ribera et al., 2001) et enfin dans le Rif, elle a été mentionnée dans trois localités appartenant à deux provinces: Cap Spartel à Tanger (Escalera, 1914; Fery & Brancucci, 1997) et Fnidek (Fery & Brancucci, 1997) à Tétouan. En plus de ces deux provinces nos prospections ont permis sa localisation pour la première fois à Al Hoceima, à Chefchaouen, à Larache et à Nador.

### *Deronectes hispanicus* (Rosenhauer, 1856)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-23: 22-VI-1998, 1 ♂. Larache. S-124: 11-XI-1997, 1 ♂. S-125: 10-VII-1991, 1 ♂ et 1 ♀. S-127: 21-III-1997, 1 ♂ et 3 ♀♀. S-128: 21-III-1997, 1 ♀. Tetouan. S-230: 8-V-1998, 1 ♂ et 1 ♀.

Elément Nord Africain (Maroc) avec extension en Espagne et au Sud de la France. Après la révision de Fery & Brancucci (1997) la citation de Ceuta (Lagar Mascaró, 1946; Kocher, 1964) de *Deronectes opatrinus* (Germar, 1824) est reportée à *D. hispanicus*. En



plus de cette dernière localité, elle a été signalée à Fnideq (Fery & Brancucci, 1997) dans la province de Tétouan. Nos prospections nous ont permis de le repérer dans six autres localités constituant des nouvelles citations pour les provinces de Larache et d'Al Hoceima.

*Deronectes moestus inconspicuous* (Leprieur, 1876)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-11: 16-III-1998, 2 ♂♂ et 2 ♀♀. S-16: 22-VI-1998, 3 ♀♀. S-18: 10-VI-1991, 1 ♀. S-19: 22-VI-1998, 1 ♂ et 6 ♀♀. S-23: 22-VI-1998, 2 ♂♂. S-24: 4-VI-1992, 2 ♂♂ et 3 ♀♀. Chefchaouen. S-37: 30-IV-1997, 1 ♂. S-61: 24-IV-1995, 3 ♂♂. S-69: 3-VI-1992, 1 ♀. S-70: 30-IV-1997, 1 ♂. S-80: 30-IV-1997, 2 ♂♂ et 1 ♀. S-89: 13-IV-1999, 2 ♂♂ et 1 ♀. S-91: 22-VI-1998, 15 ♂♂ et 23 ♀♀. S-92: 4-VI-1992, 4 ♂♂ et 4 ♀♀. S-93: 30-IV-1998, 1 ♂ et 4 ♀♀. S-94: 3-VI-1992, 2 ♀♀. S-99: 11-VII-1991, 4 ♂♂ et 3 ♀♀. S-100: 11-VII-1991, 7 ♂♂ et 9 ♀♀. S-101: 22-VI-1998, 4 ♂♂. S-103: 13-IV-1999, 2 ♂♂ et 2 ♀♀. S-109: 22-VI-1998, 2 ♂♂. Larache. S-124: 11-XI-1997, 2 ♂♂ et 2 ♀♀. S-127: 21-III-1997, 8 ♂♂ et 11 ♀♀. S-128: 21-III-1997, 1 ♂ et 3 ♀♀. Nador. S-147: 11-VI-1991, 1 ♀. Taza. S-213: 5-VI-1999, 1 ♂ et 1 ♀. S-214: 5-VI-1999, 1 ♂ et 1 ♀. Tetouan. S-235: 12-VII-1991, 1 ♂. S-241: 9-VII-1991, 1 ♂.

Sous espèce de diffusion Nord-Méditerranéenne avec une extension au Maroc. Dans ce dernier pays, elle a été signalée à Oujda et à Figuig (Bedel, 1925; Kocher, 1958; Chavanon et al., 2004) dans sa partie Nord orientale, à Ifrane (Fery & Brancucci, 1997) dans le Moyen Atlas et Taroudannt (Fery & Brancucci, 1997) et Marrakech (Kocher, 1958; Mohati, 1985; Bouzidi, 1989; Fery & Brancucci, 1997; Ajakane, 1998) dans le Haut Atlas. Dans le plateau central, elle est citée aux environs de Settât (Kocher, 1958), dans le Pré-rif dans le parc de Tazzeka de la province de Taza (Fery & Brancucci, 1997) et enfin dans le Rif, elle a été mentionnée dans sept localités faisant partie de trois provinces: Tanger (Bedel, 1925; Kocher, 1958; Fery & Brancucci, 1997), Chefchaouen à Talssemtane (Kocher, 1964) et Tétouan (Bennas, 1987; Fery & Brancucci, 1997). Nous la signalons pour la première fois à Larache, à Al Hoceima, à Nador et à Taza.

*Deronectes theryi* (Peyerimhoff, 1925)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-86: 21-VI-2003, 2 ♂♂ et 2 ♀♀.

Endémique du Maroc, où elle est connue uniquement de trois localités, la première étant la localité type Aïn Leuh d'Azrou au Moyen Atlas (Peyerimhoff, 1925) et les deux autres concernant le Haut Atlas: Jbel Toubkal (Kocher, 1958; Bouzidi, 1989) et Tizi-n-Test (Ribera et al., 2001). Notre capture pour la première fois dans le Rif à Majjot (Chefchaouen) constitue la citation la plus septentrionale de l'espèce au Maroc.

*Graptodytes aequalis* Zimmermann, 1918

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-108: 28-IX-1993, 1 ♂. Larache. S-117: 8-V-1997, 1 ♂. S-128: 21-III-1997, 1 ♀. Tanger. S-170: 6-X-1991, 3 ♂♂ et 3 ♀♀. S-182: 18-VI-1998, 1 ♂. S-186: 8-V-1997, 1 ♂. Taounate. S-200: 23-VII-1999, 1 ♂. Tetouan. S-242: 9-VII-1991, 7 ♂♂. S-264: 23-III-1997, 1 ♂. S-269: 28-VI-1999, 1 ♂.

Elément Nord Africain (Maroc) avec extension à la péninsule Ibérique. Au Maroc, l'espèce est confinée à sa moitié septentrionale, où elle est mentionnée sur sa façade at-



lantique entre Tanger (Bedel, 1925; Lindberg, 1939; Kocher, 1958; Fery, 1995) et Bouznika (El Alaoui, 1985) en passant par Souk l'Arbae et Rabat (Kocher, 1958), dans le Prérif au Sud de Taza (Kocher, 1958) et en fin, dans le Moyen Atlas au Sud de Timahdit (Fery, 1995). Cette dernière localité semble être la plus méridionale dans son aire de distribution. Dans le Rif, en plus de Tanger nous la signalons pour la première fois à Chefchaouen, à Larache, à Taounate et à Tétouan.

### *Graptodytes flavipes* (Olivier, 1795)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-19: 22-VI-1998, 4 ♂♂ et 9 ♀♀. Tanger. S-169: 6-X-1991, 1 ♂. S-170: 6-X-1991, 2 ♂♂. Tetouan. S-215: 28-II-1992, 1 ♀. S-222: 28-II-1992, 6 ♀♀. S-223: 13-IV-1989, 2 ♂♂ et 2 ♀♀. S-242: 9-VII-1991, 2 ♂♂.

Elément Sud-Européen avec un prolongement en Europe Atlantique, en Anatolie et au Maghreb. Au Maroc, l'espèce est confinée à sa moitié septentrionale, où elle est mentionnée sur sa façade atlantique entre Tanger (Escalera, 1914; Bedel, 1925; Alluaud, 1926; Kocher, 1958) et Casablanca (Kocher, 1958) en passant par Larache (Alluaud, 1926), Kénitra, Rabat et Mohammadia (Lindberg, 1939; Kocher, 1969; El Alaoui, 1983, 1985). Dans le Moyen Atlas elle est citée à Ifrane (Kocher, 1958). Cette dernière localité semble être la plus méridionale dans son aire de distribution. Dans le Rif, en plus de Tanger elle a été recensée à Chefchaouen (Bedel, 1925) et à Tétouan (Bennas, 1990). Nos captures ont permis de la repérer pour la première fois à Al Hoceima.

### *Graptodytes ignotus* (Mulsant, 1861)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 1 ♂. S-19: 22-VI-1998, 3 ♂♂ et 2 ♀♀. S-23: 22-VI-1998, 1 ♀. Chefchaouen. S-55: 24-III-1996, 2 ♂♂ et 2 ♀♀. S-57: 20-VII-1998, 10 ♂♂ et 20 ♀♀. S-71: 4-VI-1992, 7 ♂♂ et 1 ♀. S-73: 30-IV-1997, 10 ♂♂ et 9 ♀♀. S-76: 20-VII-1998, 2 ♀♀. S-80: 30-IV-1997, 1 ♀. S-82: 22-VIII-1999, 1 ♀. S-89: 13-IV-1999, 1 ♂ et 2 ♀♀. S-91: 22-VI-1998, 1 ♀. S-92: 4-VI-1992, 2 ♂♂ et 2 ♀♀. S-93: 30-IV-1998, 1 ♀. S-99: 11-VII-1991, 1 ♀. S-105: 11-VII-1991, 1 ♂. Larache. S-118: 18-VI-1998, 3 ♂♂ et 4 ♀♀. S-119: 24-VI-1998, 1 ♂ et 1 ♀. S-124: 11-XI-1997, 1 ♀. S-127: 21-III-1997, 1 ♀. S-133: 28-VI-1999, 1 ♂. S-134: 28-VI-1999, 1 ♂ et 3 ♀♀. S-136: 28-VI-1999, 1 ♂ et 1 ♀. Nador. S-160: 13-VI-1991, 1 ♀. Tanger. S-180: 9-VII-1991, 1 ♀. S-182: 18-VI-1998, 3 ♂♂ et 4 ♀♀. S-183: 18-VI-1998, 1 ♀. Taounate. S-193: 6-VI-1999, 1 ♀. Tetouan. S-232: 12-VII-1991, 6 ♂♂ et 5 ♀♀. S-234: 18-VI-1998, 2 ♂♂ et 2 ♀♀. S-241: 9-VII-1991, 3 ♂♂ et 6 ♀♀. S-242: 9-VII-1991, 3 ♂♂ et 3 ♀♀. S-246: 6-X-1991, 2 ♂♂ et 2 ♀♀. S-247: 12-VII-1991, 1 ♀. S-249: 7-X-1991, 5 ♂♂ et 7 ♀♀. S-250: 21-III-1997, 1 ♂. S-252: 30-IV-1997, 1 ♀. S-254: 9-VI-1991, 1 ♀. S-255: 23-III-1997, 1 ♂. S-267: 8-VI-1991, 1 ♂. S-269: 28-VI-1999, 9 ♂♂ et 11 ♀♀. S-270: 28-VI-1999, 1 ♂ et 2 ♀♀.

Espèce de diffusion Ouest-Méditerranéenne, connue au Maroc dans trois régions, la première s'étend sur la façade atlantique du pays entre Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958) et Casablanca en passant par Kénitra, Rabat et Bouznika (Kocher, 1938; El Alaoui, 1985), la deuxième concerne le versant Sud du Haut Atlas, aux Nord-Est de Ouarzazate (Guignot, 1946; Kocher, 1958; Guignot, 1959b) et la troisième celle de l'Anti Atlas dans la vallée de Darâa entre Tiznit et Tata (Kocher, 1958). Tanger cons-



titue la seule mention de l'espèce touchant le domaine rifain. Nos captures pour la première fois dans les provinces d'Al Hoceima, de Chefchaouen, de Larache, de Nador, de Taounate et de Tétouan montrent que l'espèce présente une ample distribution dans le Rif.

### *Graptodytes varius* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-55: 24-III-1996, 1 ♂. S-73: 30-IV-1997, 1 ♂. S-80: 30-IV-1997, 1 ♂. S-87: 13-IV-1999, 1 ♀. S-91: 22-VI-1998, 5 ♂♂ et 7 ♀♀. S-92: 4-VI-1992, 4 ♀♀. S-94: 3-VI-1992, 1 ♂ et 2 ♀♀. S-99: 11-VII-1991, 2 ♀♀. S-103: 13-IV-1999, 2 ♂♂ et 3 ♀♀. Larache. S-119: 24-VI-1998, 1 ♂ et 1 ♀. S-121: 10-VII-1991, 1 ♂. S-122: 10-VII-1991, 2 ♂♂. S-126: 9-II-1998, 1 ♂. S-127: 21-III-1997, 2 ♂♂. S-128: 21-III-1997, 4 ♂♂ et 3 ♀♀. S-130: 10-VII-1991, 1 ♀. Tanger. S-180: 9-VII-1991, 1 ♀. S-182: 18-VI-1998, 3 ♂♂ et 3 ♀♀. S-186: 8-V-1997, 1 ♂. Taza. S-205: 9-X-1991, 1 ♀. Tetouan. S-234: 18-VI-1998, 6 ♂♂ et 12 ♀♀. S-240: 23-III-1997, 1 ♂. S-241: 9-VII-1991, 2 ♀♀. S-242: 9-VII-1991, 2 ♀♀. S-244: 23-III-1997, 1 ♀. S-246: 6-X-1991, 1 ♂. S-247: 12-VII-1991, 1 ♀. S-249: 7-X-1991, 8 ♂♂ et 9 ♀♀. S-252: 30-IV-1997, 1 ♂ et 1 ♀. S-255: 23-III-1997, 2 ♀♀. S-261: 23-III-1997, 1 ♂.

Espèce de distribution Sud-Européenne avec une extension au Maghreb, signalée au Maroc dans sa partie orientale à Oujda (Kocher, 1958; Chavanon et al., 2004), dans le Moyen Atlas à Azrou (Kocher, 1958) et aux environs de Fès et Ifrane (El Alaoui, 1985), dans le plateau central au voisinage de Khénifra et Rommani (El Alaoui, 1985) et dans le Haut Atlas aux Nord Est de Ouarzazate (Escalera, 1914; Guignot, 1946; Kocher, 1958). Dans le Rif, elle est mentionnée dans la province de Larache (Kocher, 1958) et à Ceuta (Lagar Mascaró, 1946). Nos prospections ont permis de la répertorier pour la première fois dans quatre autres provinces: Chefchaouen, Tanger, Taza et Tétouan ce qui contribue à l'amplification de son aire de distribution à tout le Rif occidental.

### *Hydroporus basinotatus* Reiche, 1864

Espèce ibéro-maghrébine (Maroc, Espagne). Au Maroc, l'espèce n'est connue que de quatre localités, deux du Moyen Atlas: les environs d'Ifrane et de Béni Mellal (Kocher, 1938, 1958), la troisième, Kénitra (Kocher, 1958) et la quatrième correspond à la localité rifaine de Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958; Guignot, 1959b; Kocher, 1965; Balke & Fery; 1993). Il s'agit d'une espèce rare, et tous les efforts déployés pour la retrouver n'ont pas aboutit.

### *Hydroporus discretus* Fairmaire, 1859

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-18: 10-VI-1991, 1 ♂. S-23: 22-VI-1998, 1 ♂ et 2 ♀♀. S-26: 22-VI-1998, 2 ♀♀. S-27: 22-VI-1998, 1 ♂ et 1 ♀. S-28: 29-IX-1993, 1 ♀. S-30: 5-VI-1992, 1 ♀. Chefchaouen. S-80: 30-IV-1997, 2 ♂♂. S-86: 24-IV-1995, 2 ♂♂ et 3 ♀♀. S-87: 13-IV-1999, 3 ♂♂ et 6 ♀♀. S-89: 13-IV-1999, 2 ♂♂ et 6 ♀♀. S-91: 22-VI-1998, 1 ♀. S-92: 4-VI-1992, 6 ♂♂ et 8 ♀♀. S-93: 30-IV-1998, 5 ♂♂ et 6 ♀♀. S-94: 3-VI-1992, 2 ♂♂. S-95: 4-VI-1992, 1 ♂. S-96: 13-IV-1999, 20 ♂♂ et 28 ♀♀. S-99: 11-VII-1991, 3 ♀♀. S-100: 11-VII-1991, 1 ♂ et 1 ♀. S-101: 22-VI-1998, 4 ♂♂. S-104: 11-VII-1991, 1 ♂ et 1 ♀. S-107: 15-VI-1991, 1 ♂. S-109: 22-VI-1998, 1 ♂ et 1 ♀. S-111: 28-IX-1993, 3 ♂♂ et 6 ♀♀. Larache. S-126: 9-II-1998, 4 ♂♂ et 4 ♀♀. S-127: 21-III-1997, 2 ♂♂ et 4 ♀♀. S-128: 21-III-1997, 20 ♂♂ et 28 ♀♀. S-131: 19-III-1999, 9 ♂♂ et 31 ♀♀. S-132: 28-VI-1999, 1 ♂ et 1 ♀. S-133: 28-VI-1999, 1 ♂.



S-135: 19-III-1999, 1 ♂ et 2 ♀ ♀. S-136: 28-VI-1999, 2 ♂ ♂ et 3 ♀ ♀. Nador. S-161: 12-VI-1991, 2 ♂ ♂ et 8 ♀ ♀. Tanger. S-180: 9-VII-1991, 1 ♂. Tetouan. S-223: 13-IV-1989, 1 ♂ et 1 ♀. S-237: 21-III-1997, 1 ♂ et 5 ♀ ♀. S-238: 21-III-1997, 1 ♀. S-239: 23-III-1997, 5 ♂ ♂ et 15 ♀ ♀. S-244: 23-III-1997, 2 ♂ ♂. S-250: 21-III-1997, 5 ♂ ♂ et 11 ♀ ♀. S-255: 23-III-1997, 6 ♂ ♂ et 2 ♀ ♀. S-259: 23-III-1997, 1 ♂. S-264: 23-III-1997, 1 ♀. S-265: 23-III-1997, 1 ♂. S-267: 8-VI-1991, 1 ♀.

Elément Sibérico-Européen avec une extension en Asie occidentale et au Maroc. Dans ce dernier pays, cette espèce n'a fait l'objet que de trois mentions: Rabat (Bedel, 1925; Guignot, 1959b), les environs de Fès et Ifrane dans le Moyen Atlas (El Alaoui, 1985) et la troisième concerne une localité rifaine: Tétouan (Bennas, 1987; Bennas et al., 1992). La capture de l'espèce dans les provinces de Al Hoceima, de Chefchaouen, de Larache, de Nador, de Tanger et de Tétouan amplifie son aire de distribution rifaine.

### *Hydroporus limbatus* Aubé, 1836

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-94: 3-VI-1992, 2 ♂ ♂. Tetouan. S-223: 13-IV-1989, 2 ♂ ♂ et 1 ♀.

Espèce de distribution Ouest-Méditerranéenne, au Maroc elle est connue dans la Meseta côtière (Bedel, 1925; Kocher, 1958; El Alaoui, 1985) sur le littoral atlantique, dans le Moyen Atlas à Azemmour (Bedel, 1925; Kocher, 1958) et dans le Rif, elle a été mentionnée à Tétouan et à Chefchaouen (Bennas, 1990).

### *Hydroporus longulus* Mulsant & Rey 1861

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-26: 22-VI-1998, 1 ♂.

Espèce de distribution Européenne avec extension au Maroc. En Afrique Au Nord, elle n'est connue que d'une seule localité du Haut Atlas marocain (Guignot, 1959b; Ferry, 1999). La découverte de cette espèce au cœur de la montagne rifaine constitue donc la première citation de cette espèce dans le Rif et contribue à l'élargissement de son aire de distribution jusqu'au Nord du pays. Malgré les nombreuses prospections entomologiques réalisées durant la dernière décennie dans la région de Kétama en générale et la localité de capture en particulier (visité cinq fois), cet *Hydroporus* restait introuvable. Il s'agit d'une espèce rare (Guignot, 1959b).

### *Hydroporus lucasi* Reiche, 1866

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-16: 22-VI-1998, 1 ♀. S-18: 10-VI-1991, 1 ♂. S-19: 22-VI-1998, 1 ♂. S-23: 22-VI-1998, 2 ♂ ♂ et 4 ♀ ♀. S-25: 22-VI-1998, 2 ♂ ♂ et 2 ♀ ♀. S-26: 22-VI-1998, 1 ♂ et 1 ♀. S-28: 29-IX-1993, 3 ♀ ♀. S-30: 5-VI-1992, 1 ♀. Chefchaouen. S-38: 10-XI-1997, 1 ♀. S-64: 24-III-1996, 6 ♂ ♂. S-84: 10-VI-1991, 2 ♂ ♂ et 5 ♀ ♀. S-92: 4-VI-1992, 3 ♀ ♀. S-93: 30-IV-1998, 1 ♀. S-94: 3-VI-1992, 1 ♂. S-96: 13-IV-1999, 2 ♂ ♂ et 3 ♀ ♀. S-102: 4-VI-1992, 1 ♀. S-104: 11-VII-1991, 2 ♀ ♀. S-107: 15-VI-1991, 4 ♂ ♂ et 4 ♀ ♀. S-109: 22-VI-1998, 4 ♂ ♂ et 4 ♀ ♀. Larache. S-128: 21-III-1997, 4 ♂ ♂ et 7 ♀ ♀. S-133: 28-VI-1999, 1 ♂. S-136: 28-VI-1999, 1 ♂. Nador. S-159: 12-VI-1991, 2 ♂ ♂. S-160: 13-VI-1991, 2 ♀ ♀. Tetouan. S-223: 13-IV-1989, 10 ♂ ♂ et 5 ♀ ♀. S-239: 23-III-1997, 10 ♂ ♂ et 27 ♀ ♀. S-264: 23-III-1997, 1 ♀.

Espèce de diffusion Ouest-Méditerranéenne en plus des îles Canaries, connue au Ma-



roc sur sa façade atlantique à Tanger (Bedel, 1925), entre Kénitra et Casablanca (Bedel, 1925; El Alaoui, 1985) et à Essaouira (Escalera, 1914; Bedel, 1925; Kocher, 1958, 1964). On la retrouve, dans sa partie orientale aux environs de Oujda (Chavanon et al., 2004) et dans le Haut Atlas au Sud de Marrakech (Kocher, 1958). Dans le Rif, connue auparavant para la seule localité de Tanger, voit son aire de distribution s'enrichir de 27 nouvelles localités constituant des nouvelles citations pour les provinces d'Al Hoceima, de Chefchaouen, de Larache, de Nador et de Tétouan.

*Hydroporus marginatus* (Duftschmid, 1805)

Espèce de distribution Européenne avec extension en Asie occidentale et au Maghreb. Au Maroc elle est mentionnée de quelques localités dispersées: les environs de Jerada au Maroc Nord oriental (Alluaud, 1926; Chavanon et al., 2004), les environs de Fès et Ifrane (El Alaoui, 1985) et Midelt (Alluaud, 1926) au Moyen Atlas, Settat (Bedel, 1925) dans le plateau central, et enfin les environs de Marrakech (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Guignot, 1959b; Kocher, 1964, 1969; Bouzidi, 1989) dans le Haut Atlas. Dans le Rif, cette espèce n'est connue que par deux mentions Tanger (Bedel, 1925) et Tétouan (Bennas, 1987). Malgré les nombreuses prospections réalisées dans la zone d'étude, on n'a pas pu localiser d'autres populations.

*Hydroporus memnonius* Nicolai, 1822

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-27: 22-VI-1998, 1 ♂.

Elément Européen avec extension au Maroc, en Algérie et en Egypte. Au Maroc, aucune citation préalable à nos prospections n'a été mentionnée. La capture de cette espèce dans la province d'Al Hoceima constitue donc non seulement la première citation de l'espèce dans le Rif mais également dans tout le Maroc. Dans l'aire d'étude, l'espèce paraît présenter une localisation ponctuelle au plancher du supraméditerranéen, qui la confine aux hauts massifs du Rif central (Aïn Khandak El Anassar à 1640 m d'altitude). Malgré que le site ait été visité cinq fois, les efforts déployés pour la localisation de plus de spécimens n'ont pas abouti.

*Hydroporus obsoletus* Aubé, 1836

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-23: 22-VI-1998, 1 ♀. S-25: 22-VI-1998, 2 ♂♂ et 5 ♀♀. S-26: 22-VI-1998, 1 ♂. S-27: 22-VI-1998, 1 ♂. Chefchaouen. S-80: 30-IV-1997, 1 ♂. S-91: 22-VI-1998, 1 ♂. S-92: 4-VI-1992, 9 ♂♂ et 13 ♀♀. S-93: 30-IV-1998, 4 ♀♀. S-96: 13-IV-1999, 5 ♂♂ et 7 ♀♀. S-100: 11-VII-1991, 1 ♀. S-101: 22-VI-1998, 1 ♂. S-103: 13-IV-1999, 1 m; et 4 ♀♀. S-109: 22-VI-1998, 3 ♂♂ et 2 ♀♀. Larache. S-132: 28-VI-1999, 1 ♂. S-136: 28-VI-1999, 1 ♂ et 2 ♀♀. Tetouan. S-248: 8-VI-1991, 1 ♀. S-258: 6-V-1993, 1 ♀. S-267: 8-VI-1991, 1 ♂ et 2 ♀♀.

Elément Européen avec extension en Asie occidentale, au Maghreb et aux îles Madeires. Au Maroc, elle n'est connue que de quatre localités ponctuelles: la première dans le Moyen Atlas aux environs de Fès et de Ifrane (El Alaoui, 1985), la deuxième dans le Haut Atlas au Sud de Marrakech (Lindberg, 1939) et les deux dernières rifaines: Tanger



(Escalera, 1914; Bedel, 1925) et Talassemiane dans la province de Chefchaouen (Kocher, 1969). Dans le Rif, connue auparavant que de Tanger et de Chefchaouen, voit son aire de distribution s'enrichir de 18 autres localités constituant des nouvelles citations pour les provinces d'Al Hoceima, de Larache et de Tétouan.

*Hydroporus planus* (Fabricius, 1781)

Espèce de diffusion Turanique-Européenne avec extension au Maroc, en Algérie et en Sibérie Occidentale. Au Maroc, elle est connue dans sa partie Nord orientale, dans les environs de Oujda (Bedel, 1925; Kocher, 1958; Chavanon et al., 2004) et sur le littoral atlantique dans la zone comprise entre Kénitra et Casablanca (El Alaoui, 1985). Dans le Moyen Atlas, elle est recensée à Fès et à Ifrane (Kocher, 1958) et dans le Haut Atlas aux environs de Bou Arfa (Alluaud, 1926; Kocher, 1958). Au Prérif, elle est mentionnée au sud de Taza (Kocher, 1958) et dans le Rif à Tétouan (Bennas, 1990) dans la région de Smir.

*Hydroporus pubescens* (Gyllenhal, 1808)

Espèce de diffusion Européo-Méditerranéenne avec extension en Iran. Au Maroc, elle a été signalée sur le littoral atlantique dans la zone comprise entre Kénitra et Casablanca (El Alaoui, 1985), dans le Moyen Atlas à Azrou (Lindberg, 1939) et dans la partie méridionale du pays, elle est mentionnée dans les environs de Marrakech (Escalera, 1914; Lindberg, 1939; Guignot, 1946; Ajakane, 1998) et de Ouarzazate (Kocher, 1949, 1958) dans le Haut Atlas. Dans le Rif, elle est connue à Tanger (Escalera, 1914), à Chefchaouen (Bennas, 1990) et à Nador (Chavanon et al., 2004).

*Hydroporus tessellatus* (Drapiez, 1819)

Elément Méditerranéen avec extension en Europe Atlantique. Au Maroc, elle est signalée dans le Moyen Atlas à Fès, à Ifrane et El Hajeb (Kocher, 1938; El Alaoui, 1985) et sur le littoral atlantique à Rabat (Bedel, 1925). Dans le Rif, elle a été citée dans une seule localité de la province de Tétouan (Bennas, 1987).

*Metaporus meridionalis* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Tetouan. S-223: 22-V-1992, 2 ♂♂ et 1 ♀.

Espèce de distribution Ouest-Méditerranéenne, au Maroc c'est l'un des Dytiscidae les plus rares. Il est connu avec certitude en quatre localités seulement concernant la moitié septentrionale du pays. La première du Moyen Atlas: Ifrane (Kocher, 1958), la deuxième atlantique au environs de Rabat (El Alaoui, 1985) et les deux dernière rifaines: Tanger (Bedel, 1925) et la région de Smir à Tétouan (Bennas, 1987).

*Nebrioporus (Nebrioporus) clarkii* (Wollaston, 1862)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-2: 11-VI-1991, 14 ♂♂ et 8 ♀♀. S-7: 3-VI-1999, 1 ♂ et 4 ♀♀. S-14: 16-III-1998, 1 ♂. S-16: 22-VI-1998, 1 ♂ et 1 ♀. S-17: 22-VI-1998, 6 mm; et 12 ♀♀. S-19: 22-VI-1998, 3 ♂♂ et 2 ♀♀. S-20: 16-III-1998, 3 ♂♂ et 1 ♀. S-24: 4-VI-1992, 2 ♂♂ et



1 ♀. Chefchaouen. S-34: 7-V-1993, 1 ♂ et 1 ♀. S-35: 7-V-1993, 2 ♂♂ S-38: 10-XI-1997, 1 ♀. S-39: 9-VI-1991, 3 ♂♂ et 1 ♀. S-42: 28-VIII-1994, 1 ♂ et 3 ♀♀. S-43: 28-VIII-1994, 2 ♂♂ et 6 ♀♀. S-44: 28-VIII-1995, 1 ♀. S-45: 28-VIII-1994, 3 ♂♂ et 4 ♀♀. S-46: 30-IV-1997, 2 ♂♂ et 3 ♀♀. S-47: 28-VIII-1994, 1 ♂. S-61: 24-IV-1995, 1 ♂ et 1 ♀. S-73: 30-IV-1997, 1 ♂. S-76: 20-VII-1998, 1 ♀. S-86: 24-IV-1995, 1 ♂ et 1 ♀. S-91: 22-VI-1998, 1 ♂. S-94: 3-VI-1992, 2 ♂♂ Larache. S-116: 10-VII-1991, 1 ♂. S-121: 10-VII-1991, 1 ♀. Nador. S-147: 11-VI-1991, 4 ♂♂ et 2 ♀♀. S-157: 12-VI-1991, 6 ♀♀. S-158: 12-VI-1991, 15 ♂♂ et 13 ♀♀. S-160: 13-VI-1991, 17 ♂♂ et 10 ♀♀. S-161: 12-VI-1991, 1 ♂. S-162: 4-VI-1999, 4 ♂♂ et 6 ♀♀. Taounate. S-195: 5-VI-1999, 1 ♂ et 1 ♀. S-198: 5-VI-1999, 6 ♂♂ et 4 ♀♀. Taza. S-201: 13-VI-1991, 3 ♀♀. S-205: 9-X-1991, 3 ♂♂. S-209: 10-X-1991, 1 ♂. S-213: 5-VI-1999, 2 ♂♂ Tetouan. S-216: 7-V-1993, 3 ♂♂ et 1 ♀. S-217: 7-V-1993, 8 ♂♂ et 9 ♀♀. S-226: 9-VI-1991, 1 ♂. S-238: 21-III-1997, 3 ♂♂ et 3 ♀♀. S-240: 23-III-1997, 2 ♂♂ et 3 ♀♀. S-242: 9-VII-1991, 1 ♀. S-244: 23-III-1997, 1 ♀. S-266: 24-IV-1995, 1 ♂ et 1 ♀.

Espèce de diffusion Ouest-Méditerranéenne avec extension aux îles Canaries et en Turquie. Elle a été citée au Maroc dans sa partie orientale à Oujda (Bedel, 1925; Berrahou, 1995; Berrahou et al., 2000, 2001; Chavanon et al., 2004), à Figuig (Chavanon et al., 2004) et au Sud de Jerada (Alluaud, 1926), sur le littoral atlantique elle a été mentionnée à Casablanca (Escalera, 1914; Bedel, 1925), à Salé (Kocher, 1938) et à Kénitra (Reymond, 1951). Dans le Prérif elle a été citée à Sidi Kacem (Reymond, 1951), au Moyen Atlas aux environs de Fès (Lindberg, 1939; El Alaoui, 1985), dans le Haut Atlas, dans les environs de Marrakech (Escalera, 1914; Bedel, 1925; Guignot, 1946; Kocher, 1949; Bouzidi, 1989; Ajakane, 1998) et dans l'Anti Atlas entre Errachidia et Bouarfa, au Sud de Tata et de Goulmine (Kocher & Reymond, 1954). Dans le Rif, elle a été citée dans la vallée de la Moulouya (Kocher, 1954) laquelle constitue la limite Est de notre aire d'étude et tout récemment, elle vient d'être découverte dans la province de Nador (Chavanon et al., 2004). Nos captures pour la première fois dans les provinces d'Al Hoceima, de Chefchaouen, de Larache, de Taounate, de Taza et de Tétouan élargissent considérablement son aire de distribution à l'ensemble du Nord du pays.

### *Nebrioporus (Zimmermannius) ceresyi* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-11: 16-III-1998, 2 ♀♀. Chefchaouen. S-55: 24-III-1996, 1 ♂. S-63: 30-X-1998, 1 ♂. S-80: 30-IV-1997, 1 ♂ et 1 ♀. Larache. S-113: 8-V-1997, 1 ♀. S-127: 21-III-1997, 3 ♀♀. Nador. S-142: 8-VI-1992, 2 ♀♀. S-143: 6-VI-1991, 8 ♂♂ et 2 ♀♀. S-144: 2-X-1993, 1 ♂ et 2 ♀♀. S-147: 11-VI-1991, 1 ♂. S-152: 12-VI-1991, 3 ♂♂ et 10 ♀♀. Sidi Kacem. S-167: 22-VII-1999, 1 ♂. Tetouan. S-244: 23-III-1997, 1 ♂.

Espèce de diffusion Turanique-Méditerranéenne avec extension aux îles Canaries. Au Maroc l'espèce a été mentionnée sur le Littoral atlantique entre Kénitra et Casablanca et à Essaouira (Escalera, 1914; Bedel, 1925; Kocher, 1958; El Alaoui, 1985; Fery et al., 1996), au Moyen Atlas à Fès (Kocher, 1958), au Maroc oriental à Figuig (Alluaud, 1926; Kocher, 1958; Chavanon et al., 2004) et à Saidia (Chavanon et al., 2004), dans le Prérif dans la région du bas Ouerrha (Camus, 1961) et au Sud à Goulmine (Fery et al., 1996). Dans le Rif, elle est connue à Tanger (Fery et al., 1996) et à Nador (Chavanon et al., 2004). Nous la signalons pour la première fois à Al Hoceima, à Chefchaouen, à Larache, à Sidi Kacem et à Tétouan.



N.B. La localité appelée Jbel Amisitten citée par Lindberg (1939) n'a pu être localisée.  
*Porhydrus vicinus* (Aubé, 1838)

Elément Nord Africain (Maroc) avec extension à la péninsule Ibérique. Au Maroc, l'espèce se répartie surtout à la faveur du littoral atlantique où elle est signalée depuis Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958) au Nord jusqu'à Tiznit (Kocher, 1958) au Sud, en passant par Larache (Escalera, 1914), Kénitra, Rabat et Casablanca (Kocher, 1938; Kocher, 1958; El Alaoui, 1983). Les localités les plus continentales où sa présence a été mentionnée correspondent à Souk Larbae et Tiffelt (Bedel, 1925). Les deux provinces rifaines, touchées par ces citations sont Tanger et Larache.

*Scarodytes halensis halensis* (Fabricius, 1787)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-19: 22-VI-1998, 4 ♂♂ et 3 ♀♀, 11-XI-1998, 2 ♂♂ et 2 ♀♀, 20-IV-1999, 8 ♂♂ et 3 ♀♀.

Espèce de diffusion Européo-Méditerranéenne avec extension en Caucase, en Iran et en Syrie, connue au Maroc de quatre localités très dispersées Oujda (Bedel, 1925; Kocher, 1958) dans sa partie Nord orientale, Oulmés (Kocher, 1958) et les environs de Fès et Ifrane (El Alaoui, 1958) au Moyen Atlas, le Haut et le Moyen Bou Regreg, dans le plateau central (El Alaoui, 1958) et enfin les environs de Marrakech (Mohati, 1985) dans le Haut Atlas. Dans le Rif, elle n'est connue que par la seule mention de Kétama (Kocher, 1964). Durant nos prospections nous avons effectivement localisé une population de cette espèce dans la même localité.

*Stictonectes escheri* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-27: 22-VI-1998, 2 ♂♂.

Espèce de distribution Ouest-Méditerranéenne. Au Maroc, elle est connue uniquement sur la façade atlantique du pays, à Tanger (Lindberg, 1939; Kocher, 1958) et entre Kénitra et Casablanca (Kocher, 1958; El Alaoui, 1983, 1985). La première citation concerne le domaine rifain. Cette espèce considérée, comme typique de sources de montagnes (Bedel, 1925) a été localisée justement dans une source (Khandak el Anasser, S-27) au cœur du Rif centrale se trouvant au plancher du supraméditerranéen dans la province d'Al Hoceima, pour laquelle elle constitue une première citation.

*Stictonectes formosus* (Aubé, 1836)

MATÉRIEL ÉTUDIÉ. Tetouan. S-264: 23-III-1997, 2 ♂♂ et 3 ♀♀.

Elément Nord Africain (Maghreb) avec extension à la péninsule Ibérique. Au Maroc, l'espèce est signalée sur la façade atlantique du pays, à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958; Guignot, 1959b) et entre Kénitra et Casablanca (Kocher, 1938, 1958; El Alaoui, 1983, 1985). Dans le Moyen Atlas, elle est mentionnée aux environs de Fès (Kocher, 1958) et dans le Rif, en plus de Tanger elle a été citée à Tétouan (Bennas, 1987).



*Stictonectes lepidus* (Olivier, 1795)

MATÉRIEL ÉTUDIÉ. Tetouan. S-269: 28-VI-1999, 1 ♀.

Élément Ouest-Européen avec extension au Maroc. En Afrique du Nord, elle a été citée au Maroc et en Algérie (Bedel, 1925). Toutefois, l'espèce n'a pas été incluse parmi la faune Nord Africaine dans l'ouvrage de Guignot (1959b). En dépit de cela, nous avons relevée de la littérature des citations marocaines, se rapportant à cette espèce. Sa présence a été en faite, mentionnée au Moyen Atlas à Fès (Lindberg, 1939) et au Maroc oriental à Oujda et à Figuig (Bedel, 1925). Tout récemment, dans le catalogue de Chavanon et al. (2004) ces citations ont été attribuées à sa congénère *S. optatus* (Seidlitz, 1887). Dans le Rif, elle a été recensée à Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939; Kocher, 1958). Nous la signalons également à Tétouan.

*Stictonectes optatus* (Seidlitz, 1887)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-19: 22-VI-1998, 1 ♀. Chefchaouen. S-76: 20-VII-1998, 1 ♂. S-80: 30-IV-1997, 1 ♂ et 1 ♀. S-91: 22-VI-1998, 2 ♀ ♀. S-92: 4-VI-1992, 1 ♂. S-94: 3-VI-1992, 1 ♂ et 1 ♀. S-100: 11-VII-1991, 1 ♀. Larache. S-119: 24-VI-1998, 1 ♂. S-126: 9-II-1998, 1 ♀. S-127: 21-III-1997, 5 ♂ ♂ et 6 ♀ ♀. S-128: 21-III-1997, 3 ♀ ♀. S-133: 28-VI-1999, 1 ♀. Tanger. S-181: 8-V-1997, 1 ♀. S-182: 18-VI-1998, 1 ♀. Tetouan. S-242: 9-VII-1991, 2 ♀ ♀. S-249: 7-X-1991, 1 ♂ et 2 ♀ ♀. S-250: 21-III-1997, 1 ♂. S-252: 30-IV-1997, 1 ♀. S-255: 23-III-1997, 1 ♂. S-262: 27-IX-1993, 6 ♂ ♂ et 12 ♀ ♀. S-264: 23-III-1997, 3 ♀ ♀. S-267: 8-VI-1991, 1 ♂ et 8 ♀ ♀.

Espèce de diffusion Ouest-Méditerranéenne, au Maroc, quoique signalée comme espèce commune à tout le pays (Kocher, 1958), les localités concrètes de captures, se limitent à Oujda dans sa partie orientale (Berrahou et al., 2000; Chavanon et al., 2004), à la région entre Kénitra et Casablanca sur la façade atlantique (El Alaoui, 1983, 1985), aux environs de Ouarzazate (Guignot, 1946; Kocher, 1949) et de Marrakech (Kocher, 1958) dans le Haut Atlas et à l'Est de Goulmine dans l'Anti Atlas (Kocher & Reymond, 1954). Dans le Rif, elle a été citée à Tétouan (Bennas, 1987). Nos prospections nous ont permis de la repérer pour la première à Al Hoceima, à Chefchaouen, à Larache et à Tanger.

*Stictotarsus procerus* (Aubé, 1838)

MATÉRIEL ÉTUDIÉ. Tanger. S-181: 8-V-1997, 1 ♀. Tetouan. S-240: 23-III-1997, 1 ♀.

Élément Ouest-Méditerranéen. Au Maroc, la distribution de l'espèce est limitée à sa moitié septentrionale (Mazzoldi & Toledo, 1998) où elle est citée à Oujda à Fès et à Rabat. Dans le Rif elle n'est connue que par la seule mention de Tanger (Bedel, 1925; Kocher, 1958), nous l'avons capturée pour la première fois à Tétouan.

*Hydrovatus clypealis* Sharp, 1876

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-104: 11-VII-1991, 2 ♂ ♂ et 4 ♀ ♀. Nador. S-139: 7-VI-1992, 1 ♀. Tetouan. S-222: 28-II-1992, 3 ♀ ♀.

Espèce de diffusion Méditerranéenne avec extension à la Grande Bretagne, connue



au Maroc de plusieurs localités de la façade atlantique du pays, entre Souk L'Arbae et Casablanca (Bedel, 1925; Kocher, 1958; El Alaoui, 1983, 1985), dans le Moyen Atlas elle est mentionnée aux environs de Fès (Bertrand, 1938; Lindberg, 1939; Kocher, 1958) et dans le Rif, elle est citée à Tanger (Escalera, 1914; Bedel, 1925), à Tétouan, à Chefchaouen (Bennas, 1990) et à Nador (Chavanon et al., 2004). Nous la signalons dans les trois dernières provinces.

*Herophydrus musicus* (Klug, 1833)

MATÉRIEL ÉTUDIÉ. Nador. S-142: 8-VI-1992, 1 ♂. S-146: 8-VI-1992, 6 ♂♂ et 8 ♀♀.

Elément Indo-Méditerranéen avec extension au Burma, aux îles Canaries, à Tadjikistan et au Nord-Ouest de la Chine (Xinjiang). Au Maroc, elle est connue de quelques localités sahariennes (Kocher, 1958) et de Tata (Peyerimhoff, 1944) à l'Anti Atlas. Sa répartition se continue vers l'Est du pays, toujours à la faveur des régions arides et désertiques, où elle est signalée à Figuig (Alluaud, 1926; Kocher, 1958; Chavanon et al., 2004), à Bouarfa (Alluaud, 1926), à Jerada (Chavanon et al., 2004) et à l'extrême Nord oriental à Oujda (Berrahou, 1995; Berrahou et al., 2001). Dans le Rif, cette espèce a été découverte pour la première fois à l'oued Moulouya dans la province de Nador (Chavanon et al., 2004). Nous l'avons effectivement capturé dans les mêmes localités.

*Hygrotus (Coelambus) confluens* (Fabricius, 1787)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-11: 16-III-1998, 1 ♀. Chefchaouen. S-84: 10-VI-1991, 1 ♀. S-106: 11-VII-1991, 1 ♀. Nador. S-147: 11-VI-1991, 1 ♂. S-155: 4-VI-1999, 2 ♂♂ et 2 ♀♀. S-157: 12-VI-1991, 1 ♀. S-158: 12-VI-1991, 1 ♂. S-159: 12-VI-1991, 3 ♂♂ et 1 ♀. S-160: 13-VI-1991, 1 ♂. Tetouan. S-222: 28-II-1992, 2 ♂♂ et 3 ♀♀. S-245: 8-V-1993, 1 ♀.

Espèce de distribution Turanique-Européo-Méditerranéenne avec extension à l'Europe Atlantique septentrionale, aux îles Canaries, Azores et Madères et à l'Arabie. Au Maroc, elle a été citée sur sa façade atlantique à Tanger (Escalera, 1914; Bedel, 1925), entre Kénitra et Casablanca (Lindberg, 1939; El Alaoui, 1985) et à Essaouira (Lindberg, 1939), dans sa partie orientale elle est mentionnée à Oujda (Berrahou et al., 2001; Chavanon et al., 2004), à Jerada (Alluaud, 1926), à Goulmime (Kocher, 1958), à Bouarfa (Alluaud, 1926; Chavanon et al., 2004) et à Figuig (Alluaud, 1926; Kocher, 1958). Dans les domaines des Atlas, elle a été recensée dans les environs de Fès (Bertrand, 1936) au Moyen Atlas, aux environs d'Errachidia (Kocher, 1958) dans le Haut Atlas et dans les environs de Tata, de Tan-Tan et de Goulmine dans le Anti Atlas (Kocher & Reymond, 1954). Dans le Rif, en plus de Tanger, elle a été mentionnée à Tétouan (Bennas, 1987) et à Nador (Chavanon et al., 2004). Nous l'avons repérée pour la première fois à Al Hoceima et à Chefchaouen.

*Hygrotus (Coelambus) lagari* (Fery, 1992)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-104: 11-VII-1991, 1 ♂ et 2 ♀♀. S-39: 9-VI-1991, 1 ♂ et 1 ♀. Tanger. S-182: 18-VI-1998, 2 ♂♂. Tetouan. S-222: 28-II-1992, 2 ♂♂ et 2 ♀♀. S-223: 13-IV-1989, 2 ♂♂.

Elément Nord Africain (Maghreb) avec extension à la péninsule Ibérique et à la Si-



cile. Après la révision de Fery (1992), les citations marocaines de *H. parallelogrammus* (Ahrens, 1812) devront être attribuée à cette espèce. Par ailleurs, elle a été recensée sur le littoral atlantique entre Kénitra et Casablanca (Escalera, 1914; Bedel, 1925; El Alaoui, 1985; Fery, 1992), dans le Moyen Atlas, à Timahdit (Bedel, 1925), et dans le Rif à Tanger (Escalera, 1914), à Tétouan (Bennas, 1990; Fery, 1992) et à Chefchaouen (Bennas, 1990). Les nouvelles captures réalisées concernent les mêmes provinces.

*Hygrotus (Coelambus) pallidulus* (Aubé, 1850)

Espèce de distribution Méditerranéenne avec extension à l'Autriche, à l'Iran et à la Sinaï; au Maroc, elle est connue par cinq citations dont trois remontent au début du siècle et ont été reprises plus tard par d'autres auteurs: Tanger (Escalera, 1914; Bedel, 1925; Lindberg, 1939), Meseta côtière (Bedel, 1925; El Alaoui, 1985) et Essaouira (Escalera, 1914; Bedel, 1925). Dans le Rif, elle est n'est connue que de Tétouan (Bennas, 1987). Depuis lors, aucune mention, n'a pu être relevée aussi bien dans le Rif que dans le reste du Maroc.

*Hygrotus (Hygrotus) inaequalis* (Fabricius, 1777)

MATÉRIEL ÉTUDIÉ. Tetouan. S-215: 28-II-1992, 1 ♂ et 1 ♀. S-222: 28-II-1992, 4 ♀ ♀. S-223: 13-IV-1989, 1 ♂ et 9 ♀ ♀.

Élément Sibérico-Européen avec extension à la Mongolie, au moyen Orient, le Japon, le Maroc et l'Algérie. Au Maroc, l'espèce est connue dans le Moyen Atlas, à Fès (Lindberg, 1939; Kocher, 1958), à Boulmane (Bedel, 1925) et à Khenifra (Kocher, 1958) et dans la Meseta côtière, entre Kénitra et Casablanca (Lindberg, 1939; Kocher, 1964; El Alaoui, 1985). Dans le Rif, elle a été recensée à Tanger (Kocher, 1964) et à Tétouan (Bennas, 1990; Bennas et al., 1992) dans les marais de Smir. Malgré les nombreuses années de prospections dans l'ensemble du territoire rifain, elle semble que cette espèce est localisée dans ce site, aucune autre population n'a pu être découverte ailleurs.

*Hyphydrus aubei* Ganglbauer, 1892

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-64: 24-III-1996, 1 ♂ et 2 ♀ ♀. Tetouan. S-221: 13-IV-1987, 1 ♂. S-222: 28-II-1992, 2 ♂ ♂ et 8 ♀ ♀. S-223: 13-IV-1989, 1 ♂ et 1 ♀.

Espèce de distribution Méditerranéenne à l'exception du Moyen Orient et de l'Égypte à l'Est et prolongement vers le domaine Atlantique Européen à l'Ouest. Au Maroc, l'espèce est citée dans quelques localités du littoral atlantique: Kénitra (Bedel, 1925; Lindberg, 1939; El Alaoui, 1983, 1985) et Casablanca (Escalera, 1914; Bedel, 1925; Kocher, 1958; Biström, 1982), dans le Moyen Atlas, à Fès (Lindberg, 1939) à Meknés (Biström, 1982) et Ifrane (Kocher, 1958; Biström, 1982) et enfin dans le Rif à Tanger (Escalera, 1914; Bedel, 1925; Kocher, 1958; Biström, 1982), à Tétouan (Bennas, 1987, 1990) et à Chefchaouen (Bennas, 1990).

*Laccophilus hyalinus testaceus* (De Geer, 1774)

MATÉRIEL ÉTUDIÉ. Al Hoceima. S-2: 11-VI-1991, 6 ♂ ♂ et 4 ♀ ♀. S-28: 29-IX-1993, 2 ♂ ♂ et 2 ♀ ♀. Chefchaouen. S-34: 7-V-1993, 1 ♂ et 1 ♀. S-39: 9-VI-1991, 3 ♂ ♂ et 3 ♀ ♀. S-42: 28-



VIII-1994, 4 ♀ ♀. S-45: 28-VIII-1994, 1 ♀. S-47: 28-VIII-1994, 1 ♂ et 1 ♀. S-54: 17-IV-1997, 1 ♂. S-57: 20-VII-1998, 1 ♂ et 4 ♀ ♀. S-61: 24-IV-1995, 2 ♀ ♀. S-63: 30-X-1998, 1 ♂ et 1 ♀. S-73: 30-IV-1997, 1 ♂ et 4 ♀ ♀. S-76: 20-VII-1998, 2 ♀ ♀. S-80: 30-IV-1997, 2 ♀ ♀. S-82: 22-VIII-1999, 1 ♀. S-83: 22-VII-1999, 1 ♂. S-89: 13-IV-1999, 1 ♀. S-106: 11-VII-1991, 2 ♂ ♂ et 3 ♀ ♀. S-108: 28-IX-1993, 1 ♂ et 3 ♀ ♀. Larache. S-115: 8-V-1997, 1 ♀. S-117: 8-V-1997, 2 ♂ ♂ et 2 ♀ ♀. S-118: 18-VI-1998, 1 ♂ et 2 ♀ ♀. S-122: 10-VII-1991, 1 ♀. S-127: 21-III-1997, 1 ♀. S-128: 21-III-1997, 3 ♂ ♂. S-129: 10-VII-1991, 3 ♂ ♂ et 2 ♀ ♀. S-133: 28-VI-1999, 1 ♀. Nador. S-142: 8-VI-1992, 2 ♂ ♂ et ? ??. S-157: 12-VI-1991, 4 ♂ ♂ et 8 ♀ ♀. S-158: 12-VI-1991, 2 ♂ ♂. Tanger. S-168: 2-VII-1995, 5 ♀ ♀. S-170: 6-X-1991, 1 ♂. S-172: 9-VII-1991, 1 ♂. S-174: 2-VII-1995, 3 ♀ ♀. S-178: 8-V-1997, 1 ♂ et 3 ♀ ♀. S-181: 8-V-1997, 30 ♂ ♂ et 7 ♀ ♀. S-183: 18-VI-1998, 4 ♂ ♂ et 3 ♀ ♀. S-186: 8-V-1997, 5 ♂ ♂ et 4 ♀ ♀. Taounate. S-193: 6-VI-1999, 1 ♂ et 3 ♀ ♀. Taza. S-209: 10-X-1991, 1 ♂. Tetouan. S-216: 7-V-1993, 3 ♂ ♂ et 5 ♀ ♀. S-217: 7-V-1993, 2 ♀ ♀. S-220: 25-IX-1994, 1 ♀. S-226: 9-VI-1991, 1 ♂ et 3 ♀ ♀. S-227: 9-VI-1991, 4 ♀ ♀. S-232: 12-VII-1991, 3 ♂ ♂ et 3 ♀ ♀. S-233: 12-VII-1991, 2 ♂ ♂. S-234: 18-VI-1998, 2 ♂ ♂ et 3 ♀ ♀. S-235: 12-VII-1991, 1 ♂. S-237: 21-III-1997, 1 ♀. S-240: 23-III-1997, 4 ♂ ♂ et 5 ♀ ♀. S-241: 9-VII-1991, 2 ♂ ♂ et 2 ♀ ♀. S-242: 9-VII-1991, 1 ♂ et 1 ♀. S-243: 8-V-1993, 2 ♂ ♂ et 1 ♀. S-244: 23-III-1997, 4 ♂ ♂ et 6 ♀ ♀. S-249: 7-X-1991, 3 ♂ ♂. S-250: 21-III-1997, 1 ♀. S-251: 24-III-1996, 7 ♂ ♂ et 6 ♀ ♀. S-262: 27-IX-1993, 3 ♂ ♂ et 1 ♀. S-266: 24-IV-1995, 1 ♀. S-269: 28-VI-1999, 2 ♀ ♀. S-270: 28-VI-1999, 1 ♀.

Espèce de distribution Turanique-Européo-Méditerranéen avec extension aux îles Canaries et à une grande partie de la Sibérie. Au Maroc, elle est parmi les Dytiscidae les plus amplement répandus puisque pas moins de 20 citations bibliographiques réparties sur l'ensemble du territoire couvrent la carte de distribution de cette sous espèce. La majorité des domaines marocains ont été touchés par ces citations. Ainsi, elle a été mentionnée à Oujda (Bedel, 1925; Berrahou, 1995; Berrahou et al., 2001; Chavanon et al., 2004) et Figuig (Alluaud, 1926; Chavanon et al., 2004) dans la partie Nord orientale du pays, dans la région du Gharb, à Sidi Kacem (Reymond, 1951), à Kénitra et Casablanca (El Alaoui, 1985) et Tiffelt (Kocher, 1958). Toujours à la faveur du littoral atlantique elle a aussi été signalée à Essaouira (Bedel, 1925). Dans le Moyen Atlas, elle est connue à Fès, à Meknès et à Timahdit (Kocher, 1958) sur son versant Nord et à Middel (Alluaud, 1926) et Béni Mellal, (Kocher, 1958) sur son versant Sud. Dans le Haut Atlas elle se répartit selon l'arc reliant Marrakech (Lindberg, 1939; Mezdi & Giudicelli, 1986; Ajakane, 1998) à Ouarzazate (Guignot, 1946). Sa distribution se continue à travers l'Anti Atlas, dans les environs d'Errachidia (Kocher, 1938; Kocher & Reymond, 1954) et de Tata (Peyerimhoff, 1944), pour atteindre le domaine Saharien (Peyerimhoff, 1944). En dépit de ce haut degré de représentativité, deux citations seulement correspondent au domaine rifain: Tanger (Bedel, 1925) et Nador (Chavanon et al., 2004), celle de Sidi Kacem (Reymond, 1951) correspond à une localité pré-rifaine. Nos captures pour la première fois dans les provinces de Tétouan, Larache, Chefchaouen, Al Hoceima, Taounate et Taza montrent que son aire de distribution couvre également l'ensemble du Nord du pays.

### *Laccophilus minutus* (Linnaeus, 1758)

MATÉRIEL ÉTUDIÉ. Chefchaouen. S-39: 9-VI-1991, 1 ♂. S-42: 28-VIII-1994, 1 ♂. S-43: 28-VIII-1994, 4 ♂ ♂ et 4 ♀ ♀. S-47: 28-VIII-1994, 1 ♂ et 1 ♀. S-73: 30-IV-1997, 1 ♂ et 2 ♀ ♀. S-102: 4-VI-1992, 1 ♂ et 2 ♀ ♀. S-106: 11-VII-1991, 1 ♂ et 5 ♀ ♀. S-108: 28-IX-1993, 2 ♂ ♂. Larache. S-113:



8-V-1997, 1 ♂. S-114: 8-V-1997, 1 ♂. Tanger. S-174: 2-VII-1995, 1 ♂. Tetouan. S-221: 13-IV-1987, 1 ♀. S-222: 28-II-1992, 2 ♂♂. S-223: 13-IV-1989, 2 ♂♂ et 1 ♀. S-227: 9-VI-1991, 1 ♂ et 5 ♀♀.

Espèce de diffusion paléarctique à l’exception des régions les plus septentrionales, du Japon, de la Libye et des îles Canaries et extension aux îles de Java et Sumatra. Au Maroc, l’espèce est mentionnée de quelques localités de la façade atlantique du pays, depuis Kénitra à Casablanca (Lindberg, 1939; Kocher, 1958; El Alaoui, 1983, 1985), au Maroc oriental à Oujda et Jerada (Chavanon et al., 2004), dans le Moyen Atlas à Méknès (Bedel, 1925) et dans le Haut Atlas à Marrakech (Escalera, 1914; Lindberg, 1939; Mezdi & Giudicelli, 1986). Dans le Rif, elle est recensée de toutes les provinces occidentale de l’aire d’étude: Tanger (Bedel, 1925; Lindberg, 1939; Kocher, 1958), Ceuta (Lagar Mascaró, 1946), Tétouan (Bennas, 1987), Larache (Bedel, 1925) et Chefchaouen (Bennas, 1990).

*Laccophilus poecilus* Klug, 1883

Espèce de distribution Turanique-Européo-Méditerranéen avec extension au Nord-Ouest de la Chine. Au Maroc, elle est connue par une seule citation qui remonte au début du siècle. Elle correspond à la localité rifaine de Tanger (Bedel, 1925). Selon Kocher (1958) il s’agit d’une citation à confirmer mais non invraisemblable. L’espèce est provisoirement maintenue parmi les Adephaga du Rif dans l’attente de la révision de ce matériel.

Tab. 1 - Inventaire des espèces des Adephaga aquatiques du Rif.  
Abréviations. Provinces: AL: Al Hoceima; CH: Chefchaouen; LA: Larache; NA: Nador; SK: Sidi Kacem; TA: Tanger; TE: Tétouan; TN: Taounate; TZ: Taza. Catégorie chorologique: AFM: Afro-tropicale-Méditerranéenne; CAE: Centroasiatique-Européen; CEM: Centroasiatique-Européo-Méditerranéen; END: Endémique; EUM: Européo-Méditerranéen; EUR: Européenne; INM: Indiano Méditerranéenne; MED: Méditerranéenne; NAF: Nord Africaine; NAF.IBM: Ibéro-Maghrébin; PAL: Paléarctique; SCO: Subcosmopolite; SEU: S-Européen; SIE: Sibérico-Européen; TEM: Turanique-Européo-Méditerranéen; TUE: Turanique-Européen; TUM: Turanique-Méditerranéen; WEU: W-Européen; WME: W-Méditerranéenne; WPA: W-Paléarctique. Symboles: ⊙ = espèces citées; ● = nouvelles citations; ○ = espèces citées et retrouvées.

	T E	T A	L A	C H	A L	N A	T Z	T N	S K
<b>Gyrinidae Thomson, 1860</b>									
<i>Aulonogyrus (Aulonogyrus) striatus</i> (Fabricius, 1792)	●	●	●	⊙	●	●	●		MED
<i>Gyrinus (Gyrinus) caspius</i> Ménétries, 1832	⊙								TUE
<i>Gyrinus (Gyrinus) dejeani</i> Brullé, 1832	⊙	⊙	●	⊙	●	●	●		EUM
<i>Gyrinus (Gyrinus) substriatus</i> Illiger, 1807	○								TUE
<i>Gyrinus (Gyrinus) urinator</i> Stephens, 1829	⊙	○	●	●					MED
<i>Orechtochilus (Orechtochilus) villosus</i> (Müller, 1776)	○			●					SIE
<b>Haliplidae Thomson, 1860</b>									
<i>Haliplus (Liaphlus) andalusicus</i> Wehncke, 1874	⊙	○							WME
<i>Haliplus (Liaphlus) mucronatus</i> Stephens, 1828	●			●	●			●	EUM
<i>Haliplus (Liaphlus) rubidus</i> Perris, 1857		○							WME
<i>Haliplus (Neohaliplus) lineatocollis</i> (Marsham, 1802)	⊙	⊙		⊙	●	⊙			WPA
<i>Peltodytes caesus</i> (Duftschmid, 1805)	⊙	⊙		○					CAE



	T E	T A	L A	C H	A L	N A	T Z	T N	S K	
<i>Peltodytes rotundatus</i> (Aubé, 1836)	●	⊙	●	⊙				⊙		SEU
<b>Noteridae Bedel, 1880</b>										
<i>Canthydrus diophthalmus</i> (Reiche et Saulcy, 1855)		○				○				MED
<i>Noterus laevis</i> Sturm, 1834	⊙	○		⊙		○				WME
<b>Hygrobiidae Ganglbauer, 1982</b>										
<i>Hygrobia hermanni</i> (Fabricius, 1775)		⊙		⊙						MED
<b>Dytiscidae Leach, 1817</b>										
<i>Agabus (Gaurodytes) biguttatus</i> (Olivier, 1795)			●	●	●	●	●			PAL
<i>Agabus (Gaurodytes) bipustulatus</i> (Linnaeus, 1767)	○	○	●	⊙						PAL
<i>Agabus (Gaurodytes) brunneus</i> (Fabricius, 1798)	●	○		●	●			●		WME
<i>Agabus (Gaurodytes) didymus</i> (Olivier, 1795)	●	⊙	⊙	●	●	●	●			EUM
<i>Agabus (Gaurodytes) dilatatus</i> (Brullé, 1832)					○					TEM
<i>Agabus (Gaurodytes) nebulosus</i> (Forster, 1771)	⊙	○	●	●	●	⊙	●			TEM
<i>Ilybius chalconatus</i> (Panzer, 1797)	●		●	●				●		TUE
<i>Ilybius meridionalis</i> (Fabricius, 1792)	○									WME
<i>Ilybius montanus</i> (Stephens, 1828)				●						EUR
<i>Colymbetes fuscus</i> (Linnaeus, 1758)		○		●		●				CEM
<i>Colymbetes schildknechti</i> Dettner, 1983	⊙	○		●		●				WME
<i>Meladema coriacea</i> (Laporte de Castelnau, 1835)	●		●	●		○				MED
<i>Rhantus (Rhantus) suturalis</i> (Macleay, 1825)	⊙			●						SCO
<i>Copelatus atriceps</i> (Sharp, 1880-82)		○								WME
<i>Acilius (Homoelytrus) duvergeri</i> Gober, 1874		○								WME
<i>Cybister (Cybister) tripunctatus</i> (Olivier, 1795)		○		○						SCO
<i>Cybister (Melanectes) vulneratus</i> Klug, 1834		○								AFM
<i>Cybister (Scaphinectes) lateralimarginalis</i> (De Geer, 1774)	⊙	○			●					TEM
<i>Dytiscus circumflexus</i> Fabricius, 1801		○				○				TEM
<i>Dytiscus pisanus</i> Laporte de Castelnau, 1834		○	●	●						WME
<i>Eretes sticticus</i> (Linnaeus, 1767)	○	○				⊙				SCO
<i>Hydaticus (Guignotites) leander</i> (Rossi, 1790)	⊙	⊙								AFM
<i>Bidessus coxalis</i> Sharp, 1882		○	○							WME
<i>Bidessus goudoti</i> (Laporte de Castelnau, 1834)		○	○							WME
<i>Bidessus minitissimus</i> (Germar, 1824)	●	●	⊙	●	●	●	●	●	●	WME
<i>Hydroglyphus geminus</i> (Fabricius, 1792)	⊙	●	●	⊙	●	⊙		●		PAL
<i>Yola bicarinata</i> (Latreille, 1804)	●	⊙	●	●	●	●	●	●		WME
<i>Deronectes fairmairei</i> (Leprieur, 1876)	⊙	⊙	●	●	●	●	●			WME
<i>Deronectes hispanicus</i> (Rosenhauer, 1856)	⊙		●		●					NAF.IBM
<i>Deronectes moestus</i> (Fairmaire, 1858)	⊙	○	●	⊙	●	●	●			MED
<i>Deronectes theryi</i> (Peyerimhoff, 1925)				●						MED.END
<i>Graptodytes aequalis</i> Zimmermann, 1918	●	⊙	●	●				●		NAF.IBM
<i>Graptodytes flavipes</i> (Olivier, 1795)	⊙	⊙		○	●					SEU
<i>Graptodytes ignotus</i> (Mulsant, 1861)	●	⊙	●	●	●	●		●		WME
<i>Graptodytes varius</i> (Aubé, 1836)	●	●	⊙	●			●			SEU
<i>Hydroporus basinotatus</i> Reiche, 1864		○								NAF.IBM
<i>Hydroporus discretus</i> Fairmaire, 1859	⊙	●	●	●	●	●				SIE
<i>Hydroporus limbatus</i> Aubé, 1836	⊙			⊙						WME



	T E	T A	L A	C H	A L	N A	T Z	T N	S K	
<i>Hydroporus longulus</i> Mulsant & Rey 1861					●					EUR
<i>Hydroporus lucasi</i> Reiche, 1866	●	○	●	●	●	●				WME
<i>Hydroporus marginatus</i> (Duftschmid, 1805)	○	○								EUR
<i>Hydroporus memnonius</i> Nicolai, 1822					●					EUR
<i>Hydroporus obsoletus</i> Aubé, 1836	●	○	●	⊙	●					EUR
<i>Hydroporus planus</i> (Fabricius, 1781)	○									TUE
<i>Hydroporus pubescens</i> (Gyllenhal, 1808)				○		○				EUM
<i>Hydroporus tessellatus</i> (Drapiez, 1819)	○									MED
<i>Metaporus meridionalis</i> (Aubé, 1836)	⊙	○								WME
<i>Nebrioporus (Nebrioporus) clarkii</i> (Wollaston, 1862)	●		●	●	●	⊙	●	●	○	WME
<i>Nebrioporus (Zimmermannius) ceresyi</i> (Aubé, 1836)		○	●	●	●	⊙			●	TUM
<i>Porhydrus vicinus</i> (Aubé, 1838)		○	○							NAF.IBM
<i>Scarodytes halensis</i> (Fabricius, 1787)					⊙					EUM
<i>Stictonectes escheri</i> (Aubé, 1836)		○			●					WME
<i>Stictonectes formosus</i> (Aubé, 1836)	⊙	○								NAF.IBM
<i>Stictonectes lepidus</i> (Olivier, 1795)	●	○								WEU
<i>Stictonectes optatus</i> (Seidlitz, 1887)	⊙	●	●	●	●					WME
<i>Stictotarsus procerus</i> Aubé, 1838	●	⊙								WME
<i>Hydrovatus clypealis</i> Sharp, 1876	⊙	○		⊙		⊙				MED
<i>Herophydrus musicus</i> (Klug, 1833)						⊙				INM
<i>Hygrotus (Coelambus) confluens</i> (Fabricius, 1787)	⊙	○		●		⊙	●			TEM
<i>Hygrotus (Hygrotus) inaequalis</i> (Fabricius, 1777)	⊙	○								SIE
<i>Hygrotus (Coelambus) lagari</i> (Fery, 1992)	⊙	⊙		⊙						NAF.IBM
<i>Hygrotus (Coelambus) pallidulus</i> (Aubé, 1850)	○	○								MED
<i>Hyphydrus aubei</i> Ganglbauer, 1892	⊙	○		⊙						MED
<i>Laccophilus hyalinus</i> (De Geer, 1774)	●	⊙	●	●	●	⊙	●	●	○	WPA
<i>Laccophilus minutus</i> (Linnaeus, 1758)	⊙	⊙	⊙	⊙	●					PAL
<i>Laccophilus poecilus</i> Klug, 1883		○								TEM
Espèces citées	37	52	7	19	1	15	0	1	2	○
Nouvelles citations	18	6	24	28	28	13	13	10	2	●
Total des espèces	55	58	31	47	29	28	13	11	4	

COMMENTAIRE

D’après les résultats de cette étude et les données bibliographiques, le Rif serait peuplé par 81 espèces de Coléoptères aquatiques Adephaga. Parmi les espèces citées au Rif et non retrouvées durant nos prospections (tab. 1) *Haliplus rubidus*, *Laccophilus poecilus*, *Hydroporus basinotatus*, *Acilius duvergeri* et *Cybister tripunctatus africanus* n’ont pas fait l’objet de nouvelles captures depuis le début du siècle et ce non seulement au Rif mais à l’échelle de tout le Maroc. Il s’agit sans doute d’une situation alarmante qui incite à la réalisation de campagnes de prospections à la recherche de ces espèces avant d’avancer des conclusions sur leur statut au Maroc. Quant aux restes des espèces, leur situation est moins inquiétante, étant donné que certaines viennent d’être capturées au Maroc oriental (Chavanon et al., 2004) et les autres ont fait l’objet au moins d’une citation durant les vingt dernières années.



Parmi les résultats faunistiques les plus intéressants, il est à signaler d'une part, la découverte pour la première fois au Maroc de l'espèce *Hydroporus memnonius* et d'autre part la confirmation de la présence jusque la douteuse de l'espèce *Ilybius montanus*. En outre 6 autres espèces connues uniquement du Maroc central et/ou méridional sont citées pour la première fois pour cette contrée du pays (tab. 1). D'autre part, en ce qui concerne les catalogues provinciaux propres à chacune des provinces rifaines, ce travail a permis d'apporter les premières données sur les Hydradephaga relatives à la province de Taza. Il nous a aussi été possible d'ajouter 28 nouvelles citations pour la province de Chefchaouen et d'Al Hoceima, 24 pour Larache, 18 pour Tétouan, 13 pour Nador, 10 pour Taounate, 6 pour Tanger et enfin 2 pour Sidi Kacem. Toutes ces nouveautés fournissent plus de 90% des espèces connues actuellement pour les provinces d'Al Hoceima et de Taounate, entre 60 et 80% pour celles de Chefchaouen et Larache, entre 30% et 50 % pour Tétouan, Nador et Sidi Kacem et enfin un peu plus de 10% pour la province de Tanger.

La comparaison de la richesse en taxons des Hydradephaga du Rif avec celle du Maroc (Ribera et al. 2001; Löbl & Smetana, 2003) montre que les Hygrobiidae (1 espèce), les Noteridae (2 espèces) et les Gyrinidae (6 espèces) présentent la totalité des espèces peuplant le Maroc. Elles sont suivies par les Haliplidae (6 de 8 espèces) et les Dytiscidae (66 de 93 espèces) représentant plus de 70 % des espèces marocaines.

D'un point de vue générique, 97% des genres connus au Maroc peuple le Rif, *Methles* Sharp, 1882 serait le seul genre qui fait exception. En outre, le Rif avec ses 81 espèces certaines d'Hydradephaga, possède plus de 75% des espèces marocaines. Ce pourcentage est assez illustratif de la grande diversité spécifique du peuplement des Coléoptères aquatiques dans l'aire d'étude, et pourtant le Rif ne représente que 3,9% de la superficie du Maroc.

L'analyse de la composition du peuplement des Adephaga aquatiques du Rif, montre qu'ils sont constitués essentiellement d'espèces présentant une diffusion Méditerranéenne (51%), suivis d'espèces possédant une ample distribution dans le domaine Paléarctique (31 %) et celles de diffusion principalement Européenne avec une extension au Maroc ou au Maghreb (11.11 %). Les éléments Cosmopolites et ceux dont la distribution s'étend au delà du bassin méditerranéen soit en Inde, soit dans la région Afrotropicale constituent une minorité (6%). Au sein des éléments Méditerranéens des Hydradephaga du Rif, il y'a une nette prédominance du corotype Ouest-Méditerranéen (54 %). En outre les espèces à distribution restreinte au Maroc et à la péninsule Ibérique l'emportent sur les endémiques marocains de telle sorte que des 7 espèces endémiques du Maroc (Ribera et al., 2001; Löbl & Smetana, 2003) uniquement *Deronectes theryi* a été repérée dans le Rif.

#### REMERCIEMENTS

Nous remercions vivement les lecteurs anonymes pour les critiques judicieuses sur le manuscrit et par la même occasion nous exprimons notre reconnaissance aux Docteurs Ignacio Ribera et Andrés Millán pour le support bibliographique et la collaboration illimitée. Ce travail a partiellement bénéficié du projet Protars sous le N°: P2T3/39.



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Appendice 1 - Stations prospectées avec les indications de la localité, la province, l’altitude, les coordonnées géographiques, les coordonnées UTM et le type du milieu aquatique.

Abréviations. BR: barrage; CA: canal d’irrigation artificiel; CN: canal d’irrigation naturel; CO: rivière et ruisseau; LG: lagune; MA: mare; MR: marais; PU: puit; SA: source aménagée; SN: source naturelle.

N°	Station	Localité	Altitude	C. Géographiques	C. UTM	TM
AL HOCEIMA						
S-1	Oued Iberlouken	Ajdir	20 m	35°11’45’’ N ; 3°53’35’’ W	30SVD1999	CO
S-2	Oued Nekôr	Arbîb	30 m	35°10’32’’ N ; 3°48’16’’ W	30SVD2896	CO
S-3	Oued Nekôr	Aît Moussa où Amar	40 m	35°09’19’’ N ; 3°49’34’’ W	30SVD2695	CO
S-4	Seguia Imzoûrene	Imzoûrene	80 m	35°08’46’’ N ; 3°51’18’’ W	30SVD1993	CA
S-5	Oued Feddal	Mestasa	100 m	35°06’21’’ N ; 4°25’33’’ W	30SUD7189	CO
S-6	Oued Beni Boufrah	Beni Boufrah	160 m	35°05’38’’ N ; 4°18’25’’ W	30SUD8288	CO
S-7	Oued Nekôr	Tizi-Mada	180 m	35°01’53’’ N ; 3°49’12’’ W	30SVD2881	CO
S-8	Oued l’Achirene	Imzouâr	198 m	35°05’16’’ N ; 4°23’21’’ W	30SUD7588	CO
S-9	Oued Imasinene	Taguidît	230 m	35°07’25’’ N ; 4°10’29’’ W	30SUD9591	CO
S-10	Oued Tarmast	Aît Dâoued	250 m	35°08’55’’ N ; 4°00’55’’ W	30SVD0979	CO
S-11	Oued Mrika	Ijelloûtene	250 m	35°08’22’’ N ; 4°05’09’’ W	30SVD0293	CO
S-12	Seguia Kerker	Bâdes	400 m	35°09’11’’ N ; 4°16’02’’ W	30SUD9585	CN
S-13	Oued Handoûne	Beni Abdellah	760 m	35°03’22’’ N ; 4°05’46’’ W	30SVD0182	CO
S-14	Oued El Joumoua	Targuist	910 m	34°55’49’’ N ; 4°22’06’’ W	30SUD8365	CO
S-15	Seguia Oued El Joumoua	M. F. Targuist	920 m	34°55’48’’ N ; 4°18’31’’ W	30SUD8271	CN
S-16	Oued Sgara	Tleta Ketama	1300 m	34°52’29’’ N ; 4°37’07’’ W	30SUD5463	CO
S-17	Oued Ketama	El Mouzarâr	1340 m	34°52’42’’ N ; 4°36’57’’ W	30SUD5464	CO
S-18	Ruisselet Aïn el Beïda	Aïn el Beïda	1400 m	34°58’58’’ N ; 4°30’33’’ W	30SUD6475	CO
S-19	Oued Ketama	Koudiat Echchiba	1480 m	34°59’03’’ N ; 4°34’34’’ W	30SUD5875	CO
S-20	Oued Mrinet	Ouareg	1500 m	34°57’07’’ N ; 4°27’16’’ W	30SUD7072	CO
S-21	Aïn Tâch	Ketama	1520 m	34°53’30’’ N ; 4°36’22’’ W	30SUD5565	SN
S-22	Daya de Aïn Chiker	Jbel Tidrhine	1540 m	34°51’01’’ N ; 4°36’47’’ W	30SUD5460	MA
S-23	Ruisselet Iouchirene	Tidouine	1540 m	34°55’06’’ N ; 4°32’01’’ W	30SUD5368	CO
S-24	Oued Ketama	Koudiat Tiskat	1560 m	34°50’35’’ N ; 4°40’27’’ W	30SUD4959	CO
S-25	Oued Oûringa Tamda	Sikh	1580 m	34°55’38’’ N ; 4°35’56’’ W	30SUD4869	CO
S-26	Aïn Quanquben	Jbel Bou Bessoui	1600 m	34°57’45’’ N ; 4°40’47’’ W	30SUD4074	CO
S-27	Aïn K. En Nasser	Khandek En Nasser	1640 m	34°53’04’’ N ; 4°43’35’’ W	30SUD4564	CO
S-28	Berket Bab-Chiker	Jbel Tidrhine	1700 m	34°50’53’’ N ; 4°36’28’’ W	30SUD5560	MA
S-29	Aïn Imaou	Jbel Tidrhine	1800 m	34°50’32’’ N ; 4°35’29’’ W	30SUD5860	CO
S-30	Aïn Imazdamene	Jbel Tidrhine	1880 m	34°50’24’’ N ; 4°34’05’’ W	30SUD5959	CO
S-31	Aïn Pic J. Tidrhine	Jbel Tidrhine	2000 m	34°50’38’’ N ; 4°33’21’’ W	30SUD6059	SN
CHAOUEN						
S-32	Oued Laou	Oued Laou Village	10 m	35°26’37’’ N ; 5°06’08’’ W	30SUE1127	CO
S-33	Oued Amter	Amter	20 m	35°14’27’’ N ; 4°48’41’’ W	30SUD3799	CO
S-34	Oued Bouhya	Silloufene	20 m	35°18’30’’ N ; 4°58’16’’ W	30SUE2209	CO
S-35	Oued Kanar	Assoul	20 m	35°18’46’’ N ; 4°59’24’’ W	30SUE2112	CO
S-36	Oued Laou	Tassefete	20 m	35°25’27’’ N ; 5°06’47’’ W	30SUE1225	CO
S-37	Oued Laou	Tizrharine	20 m	35°23’38’’ N ; 5°09’08’’ W	30SUE0921	CO
S-38	Oued Ahrous	Kaa Asrasse	20 m	35°24’19’’ N ; 4°04’05’’ W	30SUE1622	CO
S-39	Oued Tihissasse	Bou Ahmed	40 m	35°19’19’’ N ; 4°58’35’’ W	30SUE2113	CO
S-40	Oued Ouringa	Jebha	40 m	35°11’42’’ N ; 4°41’18’’ W	30SUE4802	CO
S-41	Oued Laou	Afertane	40 m	35°20’56’’ N ; 5°11’18’’ W	30SUE0617	CO



S-42	Oued J. En Nich	Jenane En Nich	60 m	35°16'29" N ; 4°52'01" W	30SUE3609	CO
S-43	Oued S. Y. Aârab	Sidi Yahia Aârab	80 m	35°17'33" N ; 4°53'25" W	30SUE3511	CO
S-44	Oued Amazithen	El Ouesteyine	80 m	35°18'22" N ; 4°53'55" W	30SUE3012	CO
S-45	Oued Tarhassa	Tarhassa	80 m	35°12'50" N ; 4°44'44" W	30SUE4302	CO
S-46	Oued Es Sarem	Ibouharane	80 m	35°18'04" N ; 5°12'50" W	30SUE0411	CO
S-47	Oued Aârkob	Arherarose	100 m	35°16'04" N ; 4°50'49" W	30SUE3408	CO
S-48	Oued Tendmane	El Ouesteyine	100 m	35°18'17" N ; 4°54'34" W	30SUE3212	CO
S-49	Oued Khendek Reha	Brikcha	120 m	34°57'48" N ; 5°32'56" W	30STD7474	CO
S-50	Aïn Aïcha	Souk El Had	150 m	35°01'37" N ; 5°24'26" W	30STD8780	SA
S-51	Oued Zenndoula	Jbel Bou Zine	150 m	34°53'14" N ; 5°32'21" W	30STD7567	CO
S-52	Oued Rharrhna	Koudiat R. Rharrhna	150 m	35°58'30" N ; 5°29'01" W	30STD7976	CO
S-53	Oued Loukous	Souk El Had	162 m	35°01'29" N ; 5°25'27" W	30STD8580	CO
S-54	Oued Defali	Rmel	170 m	34°45'09" N ; 5°32'40" W	30STD7449	CO
S-55	Oued Tazarine	Beni Oualal	200 m	35°04'09" N ; 5°20'00" W	30STD9284	CO
S-56	Oued et Taoua	Dechar Boucrous	220 m	34°50'32" N ; 5°32'36" W	30STD7459	CO
S-57	Oued Nejjar	Ouezguana	220 m	34°46'11" N ; 5°29'52" W	30STD7852	CO
S-58	Oued Beni Amrane	Bou Salah	230 m	34°47'33" N ; 5°21'20" W	30STD9155	CO
S-59	Oued Es Sabbaniyine	Dar Rhaba	240 m	34°46'43" N ; 5°23'29" W	30STD8754	CO
S-60	Ruisselet Kirker	Kirker	260 m	35°04'35" N ; 5°19'08" W	30STD9587	CO
S-61	Oued Laou	Achaïch	260 m	35°12'42" N ; 5°18'55" W	30STE9501	CO
S-62	Oued Laou	Croist.Chauoen	280 m	35°11'45" N ; 5°18'27" W	30STD9599	CO
S-63	Oued Laou	Rhabet Amelay	290 m	35°10'16" N ; 4°18'55" W	30STD9597	CO
S-64	Daya Derdara	Derdara	300 m	35°08'46" N ; 5°17'56" W	30STD9693	MA
S-65	Oued Aoulai	Afertane	300 m	34°49'35" N ; 4°55'56" W	30SUD2558	CO
S-66	Oued Arhemrate	El Kouk	330 m	34°54'11" N ; 5°03'43" W	30SUD1767	CO
S-67	Oued Talembote	Talembote	340 m	35°15'00" N ; 5°11'47" W	30SUE0604	CO
S-68	Oued Laou	Chauoen/ Dardara	360 m	35°06'45" N ; 5°17'27" W	30STD9789	CO
S-69	Oued Talembote	Taoûrart	380 m	35°15'16" N ; 5°12'46" W	30SUE0307	CO
S-70	Seguia Tarhzoute	Tarhzoute	380 m	35°16'04" N ; 5°14'14" W	30SUE0108	CN
S-71	Oued Bazzate	Bazzate	400 m	34°49'27" N ; 5°06'28" W	30SUD1358	CO
S-72	Oued Ouara / Oued Maggo	Beni Zid	420 m	35°06'04" N ; 5°14'40" W	30SUD0191	CO
S-73	Oued Ouara	Beni Zid	440 m	35°05'12" N ; 5°13'35" W	30SUD0287	CO
S-74	Seguia Taoûrart	Tourârt	500 m	35°19'58" N ; 5°12'42" W	30SUE0314	CN
S-75	Aïn Talembote	Talembote Village	500 m	35°15'16" N ; 5°11'18" W	30SUE0704	CO
S-76	Oued Tallet	Mokhrisset	540 m	34°55'19" N ; 5°21'06" W	30STD9269	CO
S-77	Aîn Er Rami	El Habteyine	580 m	35°08'14" N ; 4°16'28" W	30STD9893	SA
S-78	Oued Dar el Oued	Dehar	600 m	34°59'11" N ; 5°22'30" W	30STD8978	CO
S-79	Aïn Kob	Dar Hidour	600 m	34°57'17" N ; 5°21'51" W	30STD9072	SA
S-80	Oued Ouara	Jbel El Khizana	680 m	35°03'46" N ; 5°14'05" W	30SUD0185	CO
S-81	Aïn Taliouane	Râtba/ Beni Ahmed	710 m	34°51'53" N ; 5°10'52" W	30SUD0662	SN
S-82	Guelta Beni-Iafene	Tanakoub	720 m	35°05'38" N ; 5°25'21" W	30STD7990	MA
S-83	Daya Arhbaoulou	Tanakoub	760 m	35°05'40" N ; 5°24'32" W	30STD8690	MA
S-84	Daya Agelman	Douar Bouhannin	760 m	35°07'42" N ; 4°36'18" W	30SUD5592	MA
S-85	Aïn Rinou	Rinou, Jbel Tazaout	760 m	35°15'43" N ; 5°10'39" W	30SUE0808	SN
S-86	Oued Maggo	Maggo	780 m	35°06'29" N ; 5°11'08" W	30SUD0789	CO
S-87	Ruisselet FiFi	Beni Madrassene	780 m	34°58'01" N ; 5°14'06" W	30SUD0369	CO
S-88	Daya Mezine	Route de Tanakoub	780 m	35°06'12" N ; 5°21'10" W	30STD9089	MA
S-89	Ruisselet après FiFi	Beni Madrassene	800 m	34°58'46" N ; 5°13'08" W	30SUD0475	CO
S-90	Oued Abrouj	Fifi (Tourhaya)	820 m	34°59'51" N ; 5°09'42" W	30SUD0878	CO
S-91	Oued Maâmala	Beni Derkoul	840 m	35°03'35" N ; 5°04'05" W	30SUD1784	CO



S-92	Aïn Ras El Ma	Ras El Ma	840 m	35°10'24'' N ; 5°15'25'' W	30STD9997	CO
S-93	Oued Biyada	Jbel Setsou	880 m	35°04'19'' N ; 5°09'18'' W	30SUD0886	CO
S-94	Oued Kalaa	Auberge Akchour	890 m	35°14'27'' N ; 5°10'39'' W	30SUE0604	CO
S-95	Oued Bab-Taza	Bab-Taza	1000 m	35°02'42'' N ; 5°12'56'' W	30SUD0382	CO
S-96	Guelta après FiFi	Ahoundar	1000 m	34°58'03'' N ; 5°13'57'' W	30SUD0572	MA
S-97	Ruisselet après FiFi	Ahoundar	1000 m	34°58'03'' N ; 5°13'57'' W	30SUD0572	CO
S-98	Oued Tamezlif	Tamezlif	1200 m	35°00'29'' N ; 4°56'41'' W	30SUD2377	CO
S-99	Daya Machete	Machete	1200 m	35°00'56'' N ; 4°58'16'' W	30SUD2178	MA
S-100	Oued Machete	Machete	1200 m	35°00'56'' N ; 4°58'16'' W	30SUD2178	CO
S-101	Ruisselet Bou îch	Bou Rhaît	1200 m	35°00'56'' N ; 4°57'30'' W	30SUD2278	CO
S-102	Daya Fifi	Fifi	1200 m	35°01'29'' N ; 5°12'25'' W	30SUD0480	LG
S-103	Oued après FiFi	Bab El Karne	1280 m	35°00'24'' N ; 5°12'07'' W	30SUD0778	CO
S-104	Daya Anasser 1	Anasser	1300 m	35°01'12'' N ; 5°59'28'' W	30SUD1979	LG
S-105	Daya Anasser 2	Anasser	1321 m	35°01'12'' N ; 5°59'14'' W	30SUD1979	LG
S-106	Daya BeniSalah	Azaib Beni Salah	1380 m	35°01'46'' N ; 5°01'06'' W	30SUD2081	MA
S-107	Aïn Targualt	Jbel Tafirane	1380 m	34°59'51'' N ; 4°49'34'' W	30SUD3576	CO
S-108	Daya Abri	Nord Mounzil	1400 m	35°05'35'' N ; 5°09'26'' W	30SUD0889	MA
S-109	Aïn Bab Tariouente	Jbel Beni salah	1405 m	35°01'04'' N ; 5°00'27'' W	30SUD2180	CO
S-110	Ruisselet de J.Tazaout	Akane	1500 m	35°15'38'' N ; 5°08'06'' W	30SUE1107	CO
S-111	Aïn Talassemthane	M. F. Talassemthane	1700 m	35°08'06'' N ; 5°08'16'' W	30SUD0992	SN
S-112	Daya Talassemthane	Talassemtane	1800 m	35°08'14'' N ; 5°08'06'' W	30SUD1093	MA
LARACHE						
S-113	Daya oued Rhouied	Oulad khal-Khal	10 m	35°11'45'' N ; 5°56'38'' W	30STD3799	MA
S-114	Daya oued Ouarour	O. B. Ouarour	10 m	35°05'29'' N ; 5°56'22'' W	30STD3888	MA
S-115	Oued Barchlioua	Seebt de B. Zarfet	50 m	35°14'27'' N ; 5°52'36'' W	30STE4504	CO
S-116	Oued Keroûb	Aïn chejra	70 m	35°23'22'' N ; 5°45'09'' W	30STE5521	CO
S-117	Oued el Riba	Tleta- Rissana	80 m	35°13'43'' N ; 5°57'56'' W	30STE3603	CO
S-118	Aïn Dermilat	Brhârzha	150 m	35°29'11'' N ; 5°41'43'' W	30STE6032	SA
S-119	Oued Hannacha	Koudiet Ejkhoûr	170 m	35°19'09'' N ; 4°38'12'' W	30STE6513	CO
S-120	Oued Stitou	S. K. Beni Arous	190 m	35°20'56'' N ; 5°33'16'' W	30STE7218	CO
S-121	Oued Makhazen	Sidi Hiddi	192 m	35°18'38'' N ; 5°39'05'' W	30STE6412	CO
S-122	Oued El Hamma	Tleta Bni Idder	200 m	35°23'38'' N ; 5°30'39'' W	30STE7721	CO
S-123	Seguia el Medououer	Khandak Ejfeld	200 m	35°00'59'' N ; 5°30'58'' W	30STD7780	CN
S-124	Oued Bine el Ouidane	Haït el Foki	220 m	35°28'46'' N ; 4°40'50'' W	30STE6230	CO
S-125	Seguia Aïn Hebbar	Aïn Hebbâr	390 m	35°21'01'' N ; 5°35'52'' W	30STE6816	CN
S-126	Aïn S. Brahim B. Arrif	Bâb Hachef-Aïssa	500 m	35°18'22'' N ; 5°36'57'' W	30STE7317	CO
S-127	Oued Tisgris	Hmmadesh	580 m	35°22'09'' N ; 5°31'34'' W	30STE7419	CO
S-128	Oued Taïda	Taïda	590 m	35°21'12'' N ; 5°31'57'' W	30STE7417	CO
S-129	Daya S. Sliman El Amri	Aïn Sliman El Amri	620 m	35°19'03'' N ; 5°32'48'' W	30STE7413	MA
S-130	Oued dar el Haït	Dar El Haït	630 m	35°20'00'' N ; 5°33'25'' W	30STE7315	CO
S-131	Aïn el Ksour	Es Soukkâne	1200 m	35°19'03'' N ; 5°31'14'' W	30STE7812	SN
S-132	Ruisselet Bou Hachem	Pinède B. Hachem.	1200 m	35°15'59'' N ; 5°30'39'' W	30STE7708	CO
S-133	Guelta Bou Hachem 1	Pinède B. Hachem.	1200 m	35°15'59'' N ; 5°30'49'' W	30STE7708	MA
S-134	Guelta Bouhachem 2	Pic de Bou Hachem	1200 m	35°15'47'' N ; 5°30'47'' W	30STE7709	MA
S-135	Ruisselet el Ksour	Es Soukkâne	1220 m	35°19'03'' N ; 5°31'06'' W	30STE7812	CO
S-136	Ruisselet S. El Mokhfi	Pic de Bou Hachem	1400 m	35°15'16'' N ; 5°30'43'' W	30STE7705	CO
NADOR						
S-137	Seguia Bou Areg	Bou Areg	10 m	35°07'01'' N ; 2°52'56'' W	30SWD1391	CA
S-138	Seguia Bou Areg	Bou Areg	10 m	35°06'04'' N ; 2°47'56'' W	30SWD1989	CA
S-139	Merja de la Moulouya	Embouchure	20 m	35°07'03'' N ; 2°21'57'' W	30SWD5891	MR



S-140	Seguia Moulouya	Embouchure	30 m	35°03'55" N ; 2°22'56" W	30SWD5685	CN
S-141	Merja Azizatene	Smmar	50 m	35°13'38" N ; 3°10'35" W	30SVE8404	MR
S-142	Oued Lambignat	Jbel Lambignat	74 m	35°02'17" N ; 2°52'36" W	30SWD1282	CO
S-143	Oued Kert	Jouaoua	105 m	35°06'21" N ; 3°09'44" W	30SVD8689	CO
S-144	Oued Ighzer Oumassine	Zeghanghane	140 m	35°11'21" N ; 3°08'27" W	30SVD8798	CO
S-145	Oued Kert	Oulad Ali Ouamar	160 m	35°10'48" N ; 3°10'19" W	30SVD8497	CO
S-146	Sad Med. El Khamis	Mechrae Hamadi	180 m	34°39'27" N ; 2°57'07" W	30SWD0539	BR
S-147	Oued kebir	S. K. Tamsaman	190 m	35°08'38" N ; 3°38'16" W	30SVD4393	CO
S-148	Seguia Douira	Sidi Çaddiq	230 m	34°37'09" N ; 2°53'23" W	30SWD1739	CN
S-149	Oued Moulouya	Melga El Ouidane	230 m	34°32'01" N ; 3°01'38" W	30SVD9826	CO
S-150	Oued Moulouya	Chaif Moulouya	250 m	34°32'51" N ; 3°03'55" W	30SVD9328	CO
S-151	Oued Ibassou	Timazzouyine	280 m	35°01'03" N ; 2°45'52" W	30SWD2279	CO
S-152	Oued kert	Dar Driouch	280 m	34°58'38" N ; 3°21'57" W	30SVD6876	CO
S-153	Oued Nekôr	Doar Bainti	294 m	34°57'58" N ; 3°48'55" W	30SVD2773	CO
S-154	Seguia Taghzout	Sidi Ameziane	310 m	34°53'47" N ; 3°06'04" W	30SVD9072	CA
S-155	Daya de Fida Ameziane	Fida Ameziane	380 m	34°51'47" N ; 3°11'06" W	30SVD8264	LG
S-156	Bir Tamajouit	El Hammân	420 m	34°56'53" N ; 4°18'31" W	30SVD6269	PU
S-157	Daya Aïn Chifa	Timdrhert - Midar	480 m	35°54'27" N ; 3°36' 49" W	30SVD4568	MA
S-158	Seguia Aïn Chifa	Timdrhert - Midar	480 m	35°54'27" N ; 3°36' 49" W	30SVD4568	CN
S-159	Bir de Tleta Azlaf	Tleta Azlaf	590 m	34°53'30" N ; 3°48'29" W	30SVD2866	PU
S-160	Oued Sidi Mousa	Saka	740 m	34°36'53" N ; 3°26'18" W	30SVD6135	CO
S-161	Bir el Hadria	Bled Talamaraït	770 m	34°53'46" N ; 3°44'34" W	30SVD3366	PU
S-162	Oued Ibou-Akbatene	Sidi Ali Boû Akba	780 m	34°48'38" N ; 3°44'29" W	30SVD3358	CO
S-163	Oued Arhil Inebda	Tizemmourene	1054 m	34°59'49" N ; 4°14'46" W	30SUD8077	CO
SIDI KACEM						
S-164	Oued Ouerrha	Mjaâra	90 m	34°35'32" N ; 5°15'05" W	30SUD0033	CO
S-165	Oued Joumouaa	Agraz (Teroual)	170 m	35°37'50" N ; 5°17'36" W	30STD9338	CO
S-166	Oued El Haouch	Kharrouba	190 m	34°43'30" N ; 5°25'39" W	30SUD8448	CO
S-167	Oued Khenndek	Mezgaïne	290 m	34°41'37" N ; 5°21'45" W	30STD9045	CO
TANGER						
S-168	Oued Hachef	Blochhans	5 m	35°33'14" N ; 5°55'19" W	30STE6137	CO
S-169	Oued Haricha	Dar Fellak	10 m	35°31'43" N ; 5°47'56" W	30STE5138	CO
S-170	Seguia El Hajra	El Hajra	10 m	35°33'14" N ; 5°52'07" W	30STE4539	CA
S-171	Oued Tahaddart	Hajra en Nhal	10 m	35°37'09" N ; 5°55'15" W	30STE3948	CO
S-172	Oued Kebir	Tleta de Jbel Habib	20 m	35°28'14" N ; 5°54' 05" W	30STE4131	CO
S-173	Oued kebir	Ahfir	20 m	35°28'14" N ; 5°49'06" W	30STE4929	CO
S-174	Oued Gzennaïa	Gzennaïa	20 m	35°42'09" N ; 5°55'00" W	30STE4057	CO
S-175	Oued Lihoud	Contry Club	30 m	35°46'34" N ; 5°51'06" W	30STE4664	CO
S-176	Oued Charkane	Arbaa Ayacha	37 m	35°23'30" N ; 5°54'50" W	30STE3922	CO
S-177	Oued Halcu	Asilah village	40 m	35°28'30" N ; 6°01'18" W	30STE3031	CO
S-178	Oued Ayacha	Arbae-Ayacha	50 m	35°23'30" N ; 5°53'06" W	30STE4322	CO
S-179	Oued Lediâne	Mrarech	50 m	35°49'27" N ; 5°38'49" W	30STE6569	CO
S-180	Oued Bahhâra	Dar Chaoui	50 m	35°32'32" N ; 5°41'57" W	30STE5938	CO
S-181	Oued Haricha	Sidi Bou Saber	60 m	35°31'45" N ; 5°42'46" W	30STE5938	CO
S-182	Oued Ouljat Echchat	Hakkama	60 m	35°39'19" N ; 5°41'18" W	30STE6051	CO
S-183	Oued Larbi Srhir	Rhdar-Defla	60 m	35°40'45" N ; 5°42'17" W	30STE5954	CO
S-184	Oued Coringa	Golf Rmilat	90 m	35°47'25" N ; 5°52'21" W	30STE4567	CO
S-185	Aïn Parc Donabo	West d'Agla	90 m	35°47'50" N ; 5°52'36" W	30STE3969	CO
S-186	Oued Sahabaskel	Rissana Nord	120 m	35°20'06" N ; 6°00'39" W	30STE3015	CO
S-187	Aïn Route de Rmilet	Sud de Rmilet	140 m	35°47'09" N ; 5°51'55" W	30STE4566	SA



S-188	Daya Mrahrh	Rahrah	150 m	35°46'27" N ; 5°52'17" W	30STE4562	LG
TAOUNATE						
S-189	Oued Ouerrha	Fes El Bali	140 m	34°34'09" N ; 5°08'00" W	30SUD1030	CO
S-190	Oued Ouerrha	Ourtzarh/Rafsai	160 m	34°32'50" N ; 4°57'23" W	30SUD2328	CO
S-191	Oued Aoulaii	B. Ouriaguel /Rafsai	230 m	34°35'43" N ; 4°56'38" W	30SUD2432	CO
S-192	Oued Assenou	Jamaa Outka	230 m	34°41'08" N ; 4°55'39" W	30SUD2743	CO
S-193	Oued Ouerrha	Ain Aïcha	240 m	34°28'40" N ; 4°40'17" W	30SUD4921	CO
S-194	Seguia Bridya	Fichtala	250 m	34°32'25" N ; 5°10'37" W	30SUD0728	CN
S-195	Oued Ouerrha	Azib Nsara	320 m	34°30'00" N ; 4°30'00" W	30SUD6732	CO
S-196	Oued Ouerrha	Bab-Denoual	350 m	34°34'42" N ; 4°29'12" W	30SUD6732	CO
S-197	Oued Audour	Melha Aznat	420 m	34°59'43" N ; 5°05'43" W	30SUD1378	CO
S-198	Oued Ouerrha	Dhar-Souk	500 m	34°39'19" N ; 5°17'01" W	30SUD8440	CO
S-199	Ain Afrat Dessiekh	Tamesnit (L. Outka)	950 m	34°45'00" N ; 4°52'27" W	30SUD3151	SN
S-200	Ain Ras El Ma	M.F. J. Oudka	1200 m	34°45'40" N ; 4°52'07" W	30SUD3051	SN
TAZA						
S-201	Ain Messoun	El Hessiet (Guercif)	360 m	35°17'58" N ; 4°23'49" W	30SVD6401	SN
S-202	Oued Boured	Boured	820 m	34°43'55" N ; 4°06'28" W	30SVD3050	CO
S-203	Oued Ayâad	Douar O.Abdellah	840 m	34°39'19" N ; 3°31'47" W	30SVD5239	CO
S-204	Ain Tamddit	Thar Souk / Boured	900 m	34°41'04" N ; 4°11'57" W	30SUD9142	SN
S-205	Oued Imechouene	Bab-Kouane	920 m	34°42'42" N ; 4°08'16" W	30SUD9847	CO
S-206	Oued Bou imechouene	Boured	920 m	34°41'53" N ; 4°09'05" W	30SUD9755	CO
S-207	Oued Aknoul	Aknoul	930 m	34°38'14" N ; 3°51'43" W	30SVD2536	CO
S-208	Seguia Ain Zora	Douar Oulad Mimoun	980 m	34°37'58" N ; 3°32'46" W	30SVD5136	CN
S-209	Oued Ech-chaouya	Doar Od.Ouabdellah	980 m	34°36'29" N ; 3°52'17" W	30SVD2133	CO
S-210	Ain Barda	M. F. Ain Barda	1100 m	34°41'55" N ; 4°11'08" W	30SUD9246	CO
S-211	Oued Ain Hamra	Ain Hamra	1260 m	34°44'03" N ; 3°56'28" W	30SVD1551	CO
S-212	Ain Tamazguida	Col du Nador	1300 m	34°42'42" N ; 3°54'26" W	30SVD1945	SN
S-213	Oued Sarhour	Ain El Merj	1300 m	34°39'06" N ; 3°55'19" W	30SVD1841	CO
S-214	Oued Zaebal	Aoujgâl	1400 m	34°37'48" N ; 3°56'28" W	30SVD1539	CO
TETOUAN						
S-215	Merja Holiday Smir	Restinga-Smir	3 m	35°41'37" N ; 5°19'44" W	30STE9355	MR
S-216	Oued Azla	Azla	5 m	35°33'14" N ; 5°10'00" W	30STE9939	CO
S-217	Oued Imsa	Imsa	5 m	35°31'59" N ; 5°13'51" W	30SUE0137	CO
S-218	Daya Oued Negro	Negro	10 m	35°48'22" N ; 5°16'45" W	30STE9768	MA
S-219	Oued Martil	Tamouda	10 m	35°33'46" N ; 5°24'38" W	30STE8641	CO
S-220	Daya I.S.B.B.	Zone Idustrielle	10 m	35°36'37" N ; 5°18'35" W	30STE9548	MA
S-221	Daya Cabo Negro	Oued el Malah	10 m	35°36'27" N ; 5°18'15" W	30STE9252	MA
S-222	Lac Smir	Restinga-Smir	15 m	35°43'06" N ; 5°20'41" W	30STE9258	LG
S-223	Daya Smir Bouzaglal	Restinga-Smir	15 m	35°41'05" N ; 5°19'10" W	30STE9456	MA
S-224	Merja Ksar Srhir	Ksar Srhir	20 m	35°50'48" N ; 5°33'47" W	30STE7272	MR
S-225	Oued Tamernoune	Tamernoune	20 m	35°31'21" N ; 5°10'47" W	30SUE0535	CO
S-226	Oued Laou	Talelbote	20 m	35°25'16" N ; 5°05'31" W	30SUE1424	CO
S-227	Daya Kaa Assras	Talelbote	20 m	35°24'27" N ; 5°04'05" W	30SUE1623	MA
S-228	Oued Khmis	Dchiriyine	20 m	35°33'51" N ; 5°27'40" W	30STE8141	RI
S-229	Oued Rharifa	Oulad Messaaoud	30 m	35°31'04" N ; 6°00'07" W	30STE3034	RI
S-230	Oued Jbel Habib	Tleta de Jbel Habib	40 m	35°28'14" N ; 5°48'06" W	30STE5129	RI
S-231	Merja Punta Ciress	Punta Ciress	40 m	35°53'51" N ; 5°29'05" W	30STE7978	MR
S-232	Oued Achiâr	Bounezzal	50 m	35°36'37" N ; 5°29'01" W	30STE7948	CO
S-233	Daya Bounezzal	Bounezzal	50 m	35°36'37" N ; 5°29'14" W	30STE7848	MA
S-234	Oued El Oulja	Dar Chaoui	60 m	35°32'42" N ; 5°41'28" W	30STE6039	CO



S-235	Oued Srhir	Bou Abbad	64 m	35°47'01" N ; 5°32'21" W	30STE7468	CO
S-236	Oued Ankouda	Bezouâla	80 m	35°30'56" N ; 5°41'41" W	30STE6037	CO
S-237	Oued Nakhla	Koudiet Krikra	80 m	35°27'09" N ; 5°25'29" W	30STE8528	CO
S-238	Oued kebir	Koudiet Krikra	80 m	35°27'17" N ; 5°25'50" W	30STE8428	CO
S-239	Oued Fnidek	Fnidek	80 m	35°51'51" N ; 5°21'30" W	30STE9074	CO
S-240	Oued Ksar es Srhir	Pouanti de Ketama	90 m	35°47'17" N ; 5°31'18" W	30STE7568	CO
S-241	Oued Ajrass	Aïn el Hsen	90 m	35°33'06" N ; 5°32'27" W	30STE7539	CO
S-242	Oued Hmâtoune	Cruce Blanco	90 m	35°35'11" N ; 5°38' 39" W	30STE6545	CO
S-243	Oued Raoûz	Jarda	100 m	35°42'50" N ; 5°30'09" W	30STE7858	CO
S-244	Oued Raoûz	Zaouia	100 m	35°41'53" N ; 5°30'00" W	30STE7856	CO
S-245	Daya Lechkrach	Route Khmis Anjra	100 m	35°42'01" N ; 5°29'50" W	30STE7856	MA
S-246	Bir Aïn el Alka	Azaib Ain el Alka	110 m	35°35'29" N ; 5°39'18" W	30STE6444	PU
S-247	Oued El Kebir	Ahlou	180 m	35°25'00" N ; 5°27'30" W	30STE8224	CO
S-248	Oued Nakhla	Sad Nakhla	209 m	35°25'56" N ; 5°23'35" W	30STE8826	CO
S-249	Aïn Zarka	Zarka	210 m	35°31'08" N ; 5°20'29" W	30STE9235	SA
S-250	Oued El Hamma	Ararchiouch	240 m	35°22'42" N ; 5°30'00" W	30STE8819	CO
S-251	Oued Nakhla	Beni Moussa	280 m	35°23'19" N ; 5°21'57" W	30STE9021	CO
S-252	Seguia Oued Kebir	Talanfroukh	280 m	35°15'40" N ; 5°15'49" W	30STE9908	CN
S-253	Oued Rmel	Aïn Dchicha	280 m	35°52'01" N ; 5°26'45" W	30STE8374	CO
S-254	Seguia Arhelmane	S. A. B. Hassan	300 m	35°24'35" N ; 5°23'45" W	30STE8824	CN
S-255	Oued kehhaline	Tleta Tarhramt	300 m	35°47'58" N ; 5°28'19" W	30STE8067	CO
S-256	Oued Moulay Bouchta	Tarhbaloute	320 m	35°15'32" N ; 5°20'39" W	30STE9208	CO
S-257	Aïn Aïn el Jir	Rharbaouiylene	350 m	35°51'24" N ; 5°26'04" W	30STE8473	SA
S-258	Oued Mon Cantre	Rharbaouiylene	360 m	35°52'40" N ; 5°24'12" W	30STE8676	CO
S-259	Aïn El Biote	El Bioute	380 m	35°51'59" N ; 5°25'09" W	30STE8574	SA
S-260	Aïn Dmiymi	Dhar Boudersa	400 m	35°50'00" N ; 5°26'57" W	30STE8371	CO
S-261	Aïn dradia	Dradia	400 m	35°49'43" N ; 5°27'05" W	30STE8369	SN
S-262	Oued Amezzouk	Amezzouk	450 m	35°49'27" N ; 5°28'16" W	30STE8069	CO
S-263	Oued Jbel Chendir	Jbel Chendir	470 m	35°52'40" N ; 5°23'33" W	30STE8976	CO
S-264	Aïn Amezzouk	Amezzouk	470 m	35°48'14" N ; 5°27'40" W	30STE8268	SN
S-265	Aïn Hafa er Raouda	Hafa er Raouda	550 m	35°47'42" N ; 5°27'40" W	30STE8267	SN
S-266	Oued Boumarouil	Jbel Boumarouil	560 m	35°18'42" N ; 5°21'12" W	30STE9112	CO
S-267	Bir S. A. B. Hassan	S. A. B. Hassan	640 m	35°20'56" N ; 5°22'27" W	30STE9916	PU
S-268	Aïn Beni Imrane	S. A. B. Hassan	700 m	35°21'50" N ; 5°24'14" W	30STE8719	SN
S-269	Oued Ahermar	Sud de Timizar	720 m	35°18'14" N ; 5°23'00" W	30STE8812	CO
S-270	Aïn Aménagée	Sud de Timizar	850 m	35°17'30" N ; 5°23'39" W	30STE8709	SA

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## The Hydradephaga of Chios, Greece (Coleoptera Gyrinidae, Haliplidae, Noteridae, Dytiscidae)

**Abstract** - A list is provided of the Hydradephaga (Coleoptera) of the island of Chios, Greece, largely based on work done in April 2004. The list comprises three species of Gyrinidae, one species of Haliplidae and 26 species of Dytiscidae. Most of the species are new for this poorly recorded island. Conservation issues are discussed.

**Riassunto** - *Gli Idroadefagi di Chios, Grecia (Coleoptera Gyrinidae, Haliplidae, Noteridae, Dytiscidae).*

È fornita una lista degli Hydradephaga (Coleoptera) dell'Isola di Chios (Grecia), basata principalmente su ricerche condotte nell'Aprile 2004. La lista comprende tre specie di Gyrinidae, una specie di Haliplidae e 26 specie di Dytiscidae. La maggior parte sono nuove per quest'isola per la quale sono note poche segnalazioni. Problemi di conservazione sono discussi.

**Key words:** Greece, Chios, fauna, Coleoptera, Hydradephaga.

### INTRODUCTION

There is as yet no comprehensive review of the Hydradephaga of Greece, with the work of Apfelbeck (1904) perhaps coming nearest until the recent Palaearctic catalogue (Löbl & Smetana, 2003) listed 129 species. Ienigtea (1978) listed 138 species, but the more conservative treatment by Paolo Mazzoldi, Anders Nilsson and Bernhard van Vondel in the new catalogue (Löbl & Smetana, 2003) is based on great gains in knowledge in the past 20 years, and comprises 10 species of Gyrinidae, 13 of Haliplidae, one Noteridae, and 105 Dytiscidae. The beetle fauna of Chios is poorly recorded compared to neighbouring islands, and its proximity to Turkey raises the possibility of strong faunistic links with Asia Minor.

### STUDY AREA

Chios is the fifth largest of the Aegean islands (latitude 38-39° N, longitude 26° E), lying just off the Erythraean promontory of Turkey, with Lesbos to the north and Samos and Ikaria to the south. It is 30 miles north to south and, east to west, about 18 miles at its widest. Its geology is exceedingly complex (Besenecker et al., 1968), but the area is largely karstic. Land potentially capable of delivering base-poor running water is very restricted. Grey chalky limestone dominates, though the north-west area has schists and greywacke. Meikle (1955), in producing an inventory of the flora, divided the island into three parts: the mountainous north and western region, with Pelinaeon reaching 1,293 m above sea level; the Kampos, a cultivated belt of alluvium comprising the eastern lowlands surrounding and lying south of the town of Chios, known collectively as the Kampochora; and the hilly south-eastern area, known for its production of gum mastic



from *Pistacia lentiscus* L. (Anacardiaceae), and known as the Mastichochora. He noted that the island possessed no permanent rivercourses of any size, and very little marshy ground; formerly extensive forests have been destroyed, and “no woodland proper can now be said to exist”. Meikle’s conclusion that there are only two doubtfully distinct endemic elements in the Chian flora has not been upheld, as endemic thistle species are known, and the orchid fauna as a whole has been found to be exceptionally rich. Also, the Vrisson River and the river in the Kampia Gorge appear to provide permanent running water under mature woodland cover. Other running water is temporary, ranging from springline seepage through tufa to stepped pools in river watercourses. Standing water bodies are largely in cisterns, goat-watering pools, dam ponds, pools in old brickworks, and more natural lagoons where streams discharge into shingle or sand bars on beaches. There are also small areas of saltmarsh, and, most importantly, a freshwater marsh at Marmaro. A larger marsh probably existed where the airport now operates, though it would have been modified by cultivation from much earlier times, being near the main population centre.

## METHODS

Much of the survey took place 19-28 April 2004, though one of us being partly resident, the opportunity has been taken to add to records from other work. Most collecting was done with a D-framed pond net fitted with a 1 mm mesh net. However, use of much smaller devices, in particular a tea strainer, was essential in order to work seepages and small streams. Bottle traps baited with proprietary cat food were deployed at several still water sites, but they caught nothing that was not also found by netting.

Heavy rain fell in the early part of the main survey period, and this was considered beneficial to the survey in flushing out species such as the *Hydroporus bodemeyeri*. Many species were represented almost entirely by teneral adults, another consequence of a rainy episode.

The list below follows Löbl & Smetana (2003), which may be consulted for the full classification, including subgenera. Dry voucher material is in the collection of GNF, with other sampled material retained in alcohol.

## RESULTS

### Gyrinidae

*Gyrinus dejeani* Brullé, 1832 - frequent on open water in the lowlands - in the marsh at Lagkada, a dampond at Armolia, in the river by the Agia Markella Monastery, near Limnos, and at Kataraktis.

*Gyrinus distinctus* Aubé, 1838 - one male in the river by the Agia Markella Monastery on 23 April.

*Gyrinus urinator* Illiger, 1807 - common with the above species.

### Haliplidae

*Haliphus guttatus* Aubé, 1836 - one female at Lithi saltmarsh on 21 April.



## Noteridae

*Noterus clavicornis* (DeGeer, 1774) - one female in a large brickpond at Keramia near Thimiana on 20 April.

## Dytiscidae

*Agabus biguttatus* (Olivier, 1795) - This was common in most running waters from mountain to sea level. The type black form was commoner than the form with a black pronotum and brown elytra (*nigricollis* (Zoubkoff, 1833)).

*Agabus bipustulatus* (Linné, 1767) - common in small, manmade habitats, and frequent in lowland streams.

*Agabus conspersus* (Marsham, 1802) - frequent in saltmarsh pools and ditches at Lagkada Bay, Elinda Bay and Lithi Bay.

*Agabus didymus* (Olivier, 1795) - two specimens in a sandy river by the Monastery of Agia Markella, near Limnos.

*Agabus dilatatus* Brullé, 1832 - This species was found in clay-bottomed streams in the south, near Kataraktis and Komi, and from seepages at Kipouries and Karies, in the first three instances with *A. biguttatus*.

*Agabus nebulosus* (Forster, 1771) - goat pools and pools created by leaking cisterns and water supply pipes in the mountains. The form without the two pronotal spots occurred with the normal form. Larvae were frequent.

*Agabus paludosus* (Fabricius, 1801) - One specimen in the river by the Monastery of Agia Markella, near Limnos.

*Ilybius jaechi* (Fery & Nilsson, 1993) - abundant in small, vegetated ditches in Marmaro Marsh (fig. 1) in April 2004. Most specimens were teneral. No larvae were seen that might be attributable to this species. This was until recently treated as a member of *Agabus* Leach, 1817, the polyphyletic status of which has been reduced by transference of many species to a more broadly defined genus *Ilybius* Erichson, 1832 (Nilsson, 2000). It was described (Fery & Nilsson, 1993) from western Turkey and from Xanthi, Greece.

*Colymbetes fuscus* (Linné, 1758) - two with *Rhantus suturalis* (McLeay, 1825) above.

*Rhantus suturalis* (McLeay, 1825) - one in a ditch at Kato Fana by MJT on 24 April.

*Cybister tripunctatus africanus* Laporte, 1835 - common in the edge of a large brickpond at Keramia (fig. 2) on 20 April, all being female with a black underside. Paler-sided males were among eight specimens caught by trapping.

*Eretes griseus* (Fabricius, 1781) - common in a large goat pool near Cape Pirgos (fig. 3) on 26 April. The water was murky with an orange muddy suspension, and the insects were noted only when they surfaced briefly to take air, rather like large corixids than in the way





Fig. 1. The marsh at Marmora, the only place found with *Ilybius jaechi* and *Graptodytes sedilloti phrygius*.



Fig. 2. The old brickpit pond at Keramia, a site for *Cybister tripunctatus africanus*, *Herophydrus musicus*, *Hydrovatus cuspidatus*.





Fig. 3. A goat pool at Cape Pirgos, a site for *Eretes griseus*.



Fig. 4. A single female of *Hydroporus bodemeyeri* was found in a saline ditch at Lagkada Bay just beyond the reservoir illustrated. Its true habitat was subsequently discovered in the hills above this site.





Fig. 5. Tufa-covered seepage, the habitat for *Hydroporus bodemeyeri*.

typical of most diving beetles. *Eretes* Laporte, 1833 was reviewed by Miller (2002), who identified the need for name changes when recognising the existence of two species, *E. sticticus* (Linné, 1767) and *E. griseus*, in the Mediterranean fauna. *Eretes griseus* is the most widely distributed of the four known species, ranging from southern Europe through Africa and the Far East to northern Australia. Miller (2002) did not detail the southern European finds, so this might be regarded as the first confirmed Greek record of this taxon in its recently created status. GNF's collection also contains a teneral male, taken at light on Thassos Town by Adrian P. Fowles on 18 September 1995.

*Bidessus calabricus* Guignot, 1957 - in fine silt at the edge of running water below Katavasi and in the rivers at Fyta and Kampia Gorge. Fery's (1991) treatment instated Guignot's subspecies of *B. minutissimus* (Germar, 1824) as the most common eastern Mediterranean representative of the *minutissimus*-group, found in Italy, Yugoslavia, Bulgaria, Macedonia, over much of Greece, including Chios, where it was found by d'Orchymont in 1933, and in Turkey, Syria, and Israel.

*Hydroglyphus geminus* (Fabricius, 1792) - one specimen in the agricultural dampond at Armolia.

*Deronectes sahlbergi* Zimmermann, 1932 - found in almost all running water, often in abundance in clear mountain streams, and with its larvae. Fery & Brancucci (1997), in revising this genus, ratified its specific status and reported it from Chios. The type locality for this species is Lesbos, and it is also known from Turkey.



*Graptodytes sedilloti phrygius* Guignot, 1942 - abundant in narrow, vegetated ditches on black soil at Marmaro Marsh (fig. 1). Fery (1994) recognised two subspecies, *G. sedilloti sedilloti* (Régimbart, 1877) from Syria, Israel and Cyprus, and *G. s. phrygius* in Turkey, Greece and Macedonia. The most recent published record (Nardi, 2004) is the first for European Turkey on the Dardanelles strait.

*Hydroporus bodemeyeri* Ganglbauer, 1900 - a single female was found in a saltmarsh ditch at Lagkada Bay (fig. 4) on 19 April, and then a male in a rocky channel of a stream below Katavasi on 22 April. Neither habitat seemed appropriate for one of the species of the *Hydroporus memnonius* group with asymmetrical aedeagi (formerly treated as a subgenus *Sternoporus* Falkenström, 1930), so a special effort was made to find better habitats. Eight specimens were found in a road gully below extensive tufa-covered seepages near Kipouries (fig. 5), and a further ten in hillside springs discharging into an old quarry (subsequently a waste disposal site) south-west of Karies. A further two specimens were found in a shallow streamside rockpool just north of Pirama. Both the latter, and the first two specimens were hard, whereas 17 of those taken on hillside spring sites were teneral, as was also a single male taken in a stream near Tripes on 28 April. This species was fully described by Miller & Fery (1995). They noted several records from Chios, near Keramos, Pirama and Agrinion, all in the 1970s, apparently the only recent published records of any dytiscid on Chios.

*Hydroporus brucki* Wehncke, 1875 - all larger *Hydroporus* Clairville, 1806 found in April would appear to belong to this species, and were largely confined to coastal pools in brackish puddles at Kato Fana, Elinda Bay and Lithi Bay. One was even found in a rockpool on the shore near Dinami Church. Wewalka (1992) has demonstrated the scale of complexity of the species around *H. planus* (Fabricius, 1781). This species is listed from Greece, Cyprus, Turkey and the Lebanon in Löbl & Smetana (2003).

*Hydroporus tessellatus* (Drapiez, 1819) - by far the commonest species of water beetle on the island, to be found in all habitats, being abundant, with its larvae, in exposed running or still waters. Fery (2002) invoked the fourth edition of the International Code of Zoological Nomenclature to instate the name *tessellatus* on the basis of its long history of use, earlier synonyms being treated as *nomina oblita*.

*Nebrioporus ceresyi* (Aubé, 1838) - This was abundant in one end of a saltmarsh ditch at Lithi Bay. The status of species in this group was reviewed by Fery et al. (1996), who noted records for Crete, the Cyclades, the Peloponnese, and the Greek mainland.

*Nebrioporus suavis* (Sharp, 1882) - frequent in plunge pools in fast water such as the Nagos, the Fyta and the Vrison Rivers, and the river in the Kampia Gorge, often with larvae. It was also found by MJT in a roadside spring water collection point at Kipouries on 5 April. Löbl & Smetana (2003) list this species from Azerbaijan, Albania, Armenia, Bulgaria, Georgia, Greece, Macedonia, Yugoslavia in Europe, and in Turkey and Syria. Franciscolo (1979) noted with some doubt records from Sardinia and Sicily. Previous Greek records are for the mainland and Cephallonia (Franciscolo, 1979).



*Hydrovatus cuspidatus* (Kunze, 1818) - frequent in the extreme edge of the brickpond at Keramia (fig. 2).

*Herophydrus musicus* (Klug, 1834) - common in the large brickpond at Keramia (fig. 2) and in an artificial pond at Armolia. The most recent treatment of this species is in relation to other *Herophydrus* Sharp, 1882 occurring in Africa (Biström & Nilsson, 2002). They note its distribution as Spain, including the Canaries, northern Africa from Morocco to Egypt, Chad, Syria, Iraq, Iran, Turkmenistan, Pakistan, and Yemen. In addition to Africa and Asia, *H. musicus* is listed in Löbl & Smetana (2003) from the following countries in Europe: Albania, Armenia, Georgia, Greece, Italy, Malta and Spain.

*Hyphydrus aubei* Ganglbauer, 1891 - common, usually with its larvae, in still freshwater pools including goat pools at high altitude.

*Laccophilus hyalinus* (DeGeer, 1774) - a few in the large brickpond at Keramia, also one in the river at the Agia Markella Monastery, dates as above.

*Laccophilus minutus* (Linné, 1758) - frequent in lowland standing water.

## DISCUSSION

Thirty-one species of Hydradeephaga were recorded from Chios. Most range widely in Europe or are circum-mediterranean. An analysis of the countries from which they are recorded, largely using records in Löbl & Smetana (2003), indicates that the closest, Turkey, has at least 27 species in common. A few are largely confined to Turkey and Greece, *Graptodytes sedilloti phrygius*, *Hydroporus bodemeyeri*, *H. brucki*, *Deronectes sahlbergi* and *Ilybius jaechi*. Italy and Spain (each with 22) support most of the rest, followed by Bulgaria and France (21) Croatia (20) Morocco and Syria (20), Algeria and Yugoslavia (19), Israel, Macedonia, Portugal and Tunisia (18), Bosnia Herzegovina and Cyprus (17).

The nautical inclination of Chians has left the island relatively undeveloped, the only significant losses affecting water beetles being woodland cover and possibly marshland formerly to be found on the East coast. The Marmaro Marsh, with vegetated ditches on peaty soil supporting the *Graptodytes* and *Ilybius*, appears to be the last remaining freshwater marshland system, and must rate as the island's most important site for Dytiscidae. It is also very important for some rare Lepidoptera. Next in order of importance would appear to be the base-rich seepages with *Hydroporus bodemeyeri*. Stream systems, whilst being dominated by *Deronectes sahlbergi*, are more important for their Hydraenidae; co-existence of two colour forms of *Agabus biguttatus* is of interest, since islands often have only one colour form. The ponds and natural drainage of the clay areas of the south of the island are important in supporting many diving beetle species, but none is particularly special.

The principal conservation issue would appear to be the need to raise concerns about biodiversity to prevent further loss of habitat, in particular marshland. Fish, either natural or introduced, appear to be absent, and beetles were often abundant in open water habitats, the only other predators below the water being dragonfly nymphs, in particular those of the ringtailed dragonfly, *Cordulegaster insignis* Schneider, 1845 (Odonata, Cordulegas-



teridae) in streams (Taylor, 2004), a *Notonecta* (Hemiptera, Notonectidae) in most slow and still waters, and an unidentified freshwater crab (Decapoda) in the Kampia Gorge.

There is no doubt that more species will be found, but we feel that we had near-ideal conditions early in 2004 to produce a reasonably comprehensive list. In any case we hope that it will encourage further visits to this under-researched island.

#### ACKNOWLEDGEMENTS

We are grateful to the Ministry of Agriculture, Department of National Parks and Game Management, Athens, for licensing this work as part of the initiative of Liverpool Museum. Considerable support has also been provided by Mayors of some municipalities of Chios. Michaeli Voulamandis and many other citizens of Chios have proved helpful in several ways. We are grateful to Dr Hans Fery who confirmed the identification of the *Graptodytes*, Dr Anders Nilsson similarly for the *Ilybius jaechi*, and to Professor Olof Biström for information concerning the *Herophydrus*.

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Konrad DETTNER

## Adephagan water beetles of Elba Island (Tuscany) (Coleoptera Haliplidae, Dytiscidae, Noteridae, Gyrinidae)

**Abstract** - The author provides a survey of the Hydradephaga (51 species) of Elba Island (Tyrrhenian sea, Tuscany, Italy) based on literature and on personal research. The total number of species collected by the author during 1998-2006 is 39 (1,468 specimens: 1,272/196 adults/larvae). Fifteen species are new for the island: *Haliplus guttatus* (Haliplidae), *Liopterus haemorrhoidalis*, *Hygrotus impressopunctatus*, *Hydroporus jonicus jonicus*, *H. memnonius*, *H. discretus*, *Graptodytes bilineatus*, *G. granularis*, *Agabus guttatus guttatus*, *Ilybius pederzanii*, *Melanodytes pustulatus*, *Rhantus suturalis*, *Hydaticus leander*, *H. seminiger* and *Stictotarsus procerus* (Dytiscidae). This last species is also new for Tuscany. *Agabus* ("Metronectes") *aubei*, a Tyrrhenian (Corsica and Elba) species, is recorded for the first time since 1963. For each species faunistic and zoogeographic data are provided and possible conservation aspects are discussed.

**Riassunto** - I Coleotteri Idroadefagi dell'Isola d'Elba (Toscana) (Coleoptera Haliplidae, Dytiscidae, Noteridae, Gyrinidae).

L'autore fornisce un elenco commentato degli Idroadefagi (51 specie) dell'Isola d'Elba, basato su un esame critico dei dati di letteratura e su sue nuove raccolte. L'autore, nel periodo 1998-2006, ha complessivamente, raccolto 39 specie (1.468 esemplari: 1.272 adulti e 196 larve). Quindici specie sono nuove per l'isola: *Haliplus guttatus* (Haliplidae), *Liopterus haemorrhoidalis*, *Hygrotus impressopunctatus*, *Hydroporus jonicus jonicus*, *H. memnonius*, *H. discretus*, *Graptodytes bilineatus*, *G. granularis*, *Agabus guttatus guttatus*, *Ilybius pederzanii*, *Melanodytes pustulatus*, *Rhantus suturalis*, *Hydaticus leander*, *H. seminiger* e *Stictotarsus procerus* (Dytiscidae). Quest'ultima specie è nuova anche per la Toscana. La specie corso-ilvense *Agabus* ("Metronectes") *aubei* è stata ritrovata all'Elba per la prima volta dopo il 1963. Per ogni specie sono fornite informazioni zoogeografiche e discusse le eventuali cause di minaccia.

**Key words:** Hydradephaga, Elba Island, Tuscany, *Agabus* (*Metronectes*) *aubei*, *Stictotarsus procerus*, Coleoptera.

### INTRODUCTION

In his outstanding compilation of Italian Hydradephaga, Mario Enrico Franciscolo (1979) provided maps with 1,248 Italian locations in which species of Hydradephaga had been gathered. This excellent volume of the Fauna d'Italia, with its 2,235 figures and its biological and taxonomical details, at once stimulated adephagan water beetle researchers from the Italian-Mediterranean area and from abroad. Twenty-seven years later, after considerable efforts in taxonomical, biological, chemical and molecular research on Hydradephaga, the knowledge of this fascinating group of water beetles has increased significantly, if we consider the zoogeographical and faunistic situation in Italy with its 228 Hydradephaga species (cf. Angelini, 1993). With respect to Tuscany, Franciscolo (1979) originally compiled 82 species of Hydradephaga, whereas for Elba Island he reported the presence of 25 species and stated that no case of Elban endemism could be observed. This author additionally figured 9 Elban localities in which Hydradephaga had been collected



(Franciscolo, 1979: 715, fig. 2232). His data were mainly based on earlier collections especially carried out by Binaghi (1961, 1972) and Pederzani (1967).

Shortly after the publication of Franciscolo's epochal monograph, the Hydradephaga known from Giannutri Island were compiled by Rocchi (1980) together with a detailed analysis of all known species from the whole Tuscan Archipelago and especially from Elba Island (also including unpublished records of F. Angelini and F. Pederzani). Rocchi (1980: 124, table) clearly illustrated that the total of 35 species of Hydradephaga recorded from the largest island of this archipelago seemed to be too low, since the neighbouring islands Giglio and Capraia which do not reach even a tenth of the Elban area, hosted 32 and 21 species, respectively. Later, these data were updated by Angelini (1984) and several records and additions on the hydradephagan fauna of Tuscany were provided by Rocchi (1984, 1991, 2001).

This study was accomplished in memory of the famous Italian coleopterist M. E. Franciscolo. Its main aim was to update the knowledge on the Hydradephaga of Elba with the data gathered during recent personal research on this island. Nomenclatural changes and literature records of Elban species provided by other authors are also summarized. Moreover, faunistic, zoogeographical and conservation aspects of this island are briefly discussed.

#### ELBA ISLAND AND ITS NATURAL WATERS

Elba is the largest island (223.52 km<sup>2</sup>) of the Tuscan Archipelago. It is mountainous and characterized by a mild climate with annual precipitations ranging between 600 and 950 mm (see Landi, 1989). Due to several gulfs, the island (fig. 1) may be morphologically divided into a western, central and eastern part (Waldeck, 1986).

Western Elba is dominated by the granitic Monte Capanne (1019 m). Its northern slope is wet and sometimes foggy (Marciana), whereas the southern, strongly eroded slope (Seccheto, Pomonte) is very dry. Western Elba is characterized by granodiorite and thermo-metamorphic rocks.

Central Elba is separated from western Elba by the largest plain of the Tuscan Archipelago: Campo plain (north of Marina di Campo). It is an alluvial plain where the mountains are lower and reach at most 377 m (Monte Tambone, Monte Orello).

Eastern Elba is separated from central Elba by a plain which extends from Magazzini/Lo Schiopparello (east of Portoferraio) to Golfo Stella in the south. Eastern Elba is subdivided into a southern and a northern part culminating in Cima del Monte (516 m). The southern part is constituted by the Calamita peninsula (Monte Calamita, 413 m) which is characterized by quartz-biotite schists. The plain of Mola, which is situated west of Porto Azzurro, separates the southeastern peninsula Calamita from the northeastern part of Elba. Eastern Elba, with its hematite mines, is sedimentary and characterized by porous lime formations, and exhibits metamorphic rocks (Moretti et al., 1981).

On Elba, as on other Tuscan islands there are few habitats (e.g. ponds, brooks and coastal waters) in which water is present all year round (see Terzani, 1983; Rinaldi, 2000). Natural ponds are not present on Elba and only one ("il laghetto") exists on Capraia. Due to various human activities, the few man-made ponds of Elba do not host any Hydrade-





Fig. 1. Map of Elba Island with contour-lines (according to Landi, 1989) and localities where Hydradephaga have been collected by the author (n. 1-61) or other researchers (n. 62-71). See text for descriptions of the numbered localities.

phaga (e.g. Miniera di Sassi Neri on the Calamita peninsula; Laghetto di Terranera east of Porto Azzurro; factories near Casa Buraccio north of Capoliveri). In contrast, small granite stone pits located in the southern part of western Elba (west of San Piero in Campo and north of Seccheto) may contain various water-filled depressions, where various aquatic organisms (including a few water beetles) may be found in all seasons.

On the other hand, there are various brooks and ditches which may contain water during the whole summer and autumn periods. These, e.g. Nivera (near Poggio), Pomonte, Fosso della Madonnina (southwest of Portoferraio) or Fosso di Pedalta, are found in valleys. In addition, various brooks, particularly in the mountain area of western Elba but also of the Calamita peninsula, are wet during several months and always contain some water. Generally, on western Elba water courses are longer than on eastern Elba; moreover, in the western part there are more permanent springs (see Moretti et al., 1981).

Finally, on Elba there are three coastal damp areas (see also Rinaldi, 2000) where water beetles have also been collected: Schiopparello/Le Prade in the gulf of Portoferraio, Mola in the gulf of Mola between Porto Azzurro and Capoliveri, and Campo near Marina di Campo. These wet coastal areas in particular have to be protected in the future because they are (except parts of the Mola plain) almost completely outside the Tuscan Archipelago National Park ("Parco Nazionale dell'Arcipelago Toscano"). Although there are several springs and wells which usually receive vadose water, contrary to larger islands such as Sardinia or Corsica they are usually not accessible to collectors because they are often used as water supply. Two exceptions are represented by a mountain well (see further on, sam-



pling site n. 49) situated between Pietra Murata and Piane del Canale (east of San Piero in Campo) and a well situated north of Monte le Torricelle (Calamita peninsula).

The occurrence and density of localities where water beetles have been collected do not at all correspond to the distribution of annual Elban precipitation rates (see Landi, 1989). The presence of water probably also depends on other parameters such as the extremely diverse geomorphology of the surface and the different exposure of localities. In spite of the fact that the northeastern or central parts of the island were visited several times, no hydradephagan species were found there. This situation depends on the fact that many stagnant and running waters are dry during summer and autumn (see also Moretti et al., 1981). Moreover, if water is present, it often contains high amounts of naturally occurring heavy metals; this is true for both running (e.g. Fosso di Rialbano north of Rio Marina; Fosso di Remaiolo near Fat. Ripalte on Calamita peninsula) and stagnant waters (e.g. Miniera di Sassi Neri; Laghetto di Terranera). Moretti et al. (1981) reported that these waters on eastern Elba often show a high level of hardness which may be caused by high levels of iron, and pH values between 6.0 and 7.5. In addition, many wet areas such as cisterns or water pipes were fenced in and therefore not accessible. In contrast, the chemistry of water from western Elba is characterized by pH values between 6 and 8, lower hardness and very low levels of iron (Moretti et al., 1981).

## RESULTS

**Sampling sites.** The author had the possibility to collect aquatic insects from 1998 to 2006, especially during spring but also in summer. All localities (fig. 1) where water beetles have been collected by the author (n. 1-61) and most of those sampled by other researchers (n. 62-71) were denominated according to a road atlas 1:25000 (Anonymous, 1990). "PNAT" indicates those localities which are situated inside the Tuscan Archipelago National Park (cf. Regoli, 1998; Colombini & Martino, 1999).

- 1: Uviale dei Patresi, brook east of il Mortaio, with many submerged sweet chestnuts leaves, about 200 m; PNAT, 18.IV.2001.
- 2: Fosso della Pente di Cuiello, flowing water at the base of a granite rock east of Mortigliano, 550 m; PNAT, 18.IV.2001.
- 3: Fosso della Gneccarina, brook east of Chiessi, 193 m; PNAT, 25.IV.2000.
- 4: Fosso del Bacile, brook east of Chiessi, 390 m; PNAT, 25.IV.2000.
- 5: Fosso della Porterogna, brook east of Pomonte, various specimens of *Vipera aspis francisciredi* Laurenti, 1768 (Reptilia, Viperidae) were observed at this site, 195 m; PNAT, 6.IV.1999, 19.IV.2000, 18.IV.2003, 5.VI.2004, 1.IV.2005.
- 6: Fosso Barione, broader brook east of Pomonte with various submerged granite stones and moss (*Fontinalis* sp.), 300 m; PNAT, 6.IV.1999, 19.IV.2000, 10.IV.2001, 26.III.2002, 18.IV.2003, 1.IV.2005.
- 7: broad brook with sand and granite rocks, above a bridge south of the confluence of Fosso del Malocci with Fosso dell'Inferno, northwest of Seccheto, Pradazzo area, 180 m; 10.IV.2004.
- 8: Fosso dell'Inferno, small steep brook north of Seccheto, 300 m; PNAT, 17.IV.1998.
- 9: Fosso dell'Inferno, brook situated on granite, north of Seccheto, 360 m; PNAT, 1.IV.1999.



- 10: Fosso del Malocci, shallow brook on the top of a steep rock, north of Seccheto; wet roots of phanerogamous plants with *Limnebius* spp. (Coleoptera, Hydraenidae) and *Laccobius* spp. (Coleoptera, Hydrophilidae), 410 m; PNAT, 10.IV.2004, 12.IV.2006.
- 11: Fosso San Francesco, broader brook on granitic rock base, west of Sant'Ilario in Campo, 190-220 m; PNAT, 7.IX.1997.
- 12: small well west of Valle delle Nivera, south of Poggio, with *Selaginella* sp. and *Isoetes* sp., 620 m; PNAT, 13.IV.1998.
- 13: Fosso di Pedalla, southern branch of steep rocky brooks, south of San Cerbone, 649 m; PNAT, 13.IV.1998.
- 14: Fosso di Pedalla, small brook with mosses, northeast of Monte di Cote, 678 m; PNAT, 13.IV.1998.
- 15: locality west of Podere la Casina (south of La Pila) near Marina di Campo, stagnant water/swamp, 15 m; 3.IV.2002.
- 16: swamp south of Podere la Casina (south of La Pila, southwest of locality 17) near Marina di Campo, 10 m; 18.IV.2001, 2.IV.2002, 3.IV.2002, 18.IV.2004.
- 17: locality east of Podere la Casina, ditch with stagnant water, surrounded by partly cut *Eucalyptus* trees, 6 m; 19.IV.2001.
- 18: Fosso Galeo, slow-flowing broad brook near a bridge northwest of Bonalaccia, near airport, 10 m; 19.IV.2001, 29.III.2002, 19.IV.2006.
- 19: Fosso Galeo, slow flowing broad brook east of airport, north of Bonalaccia, 12 m; 19.IV.2001.
- 20: Monte Martino, south of Villa Napoleone, small muddy pool on a forest path at summit of Monte Martino, 360 m; PNAT, 14.IV.2001, 11.IV.2006.
- 21: Monte Fonza, concrete water-butt (depth 50 cm) near road, filled with Characeae algae, north of Monte Fonza, west of Golfo della Lacona, 265 m; PNAT, 13.IV.2004.
- 22: Monte Fonza, Fosso dell'Inferno, steep rocky brook above a water reservoir, north of Monte Fonza, west of Golfo della Lacona, 120 m; PNAT, 13.IV.2004, 30.III.2005.
- 23: Monte Fonza, ditch and pool beside road, with rushes, north of Monte Fonza, west of Golfo della Lacona, 260 m; PNAT, 13.IV.2004, 30.III.2005.
- 24: slightly polluted brook north of Casa Rossa, south of Schiopparello, near Magazzini, 10 m; 20.IV.2003.
- 25: Le Prade, west of Magazzini, north of Schiopparello, swamp with rushes, 1 m; 20.IV.2003, 23.IV.2003.
- 26: northwest of Capoliveri, water ditch beside leaking water pipes, flat area north of Monte Zuccale, 9 m; 3.IV.2004, 5.IV.2004.
- 27: northwest of Capoliveri, deep meadow pool with grasses and filamentous algae, flat area north of Monte Zuccale, 9 m; 5.IV.2004.
- 28: north of Capoliveri, muddy ditch with *Iris* sp., north of Casa Mazzacorta, 6 m; 15.IV.2004.
- 29: southwest of Porto Azzurro, swamp and ditches, Mola plain, 5 m; PNAT, 14.IV.2004.
- 30: southwest of Porto Azzurro, swamp and various deep ditches with reeds and rushes, Mola plain, 1 m; PNAT, 3.IV.2002, 4.IV.2002, 15.IV.2003, 17.IV.2003, 19.IV.2003, 23.IV.2003, 25.IV.2003, 7.IV.2004, 15.IV.2004, 23.IV.2004, 25.IV.2004, 30.VII.2004,



2.IV.2005. The same habitat (“Juncetum vegetante su terreno salmastro”) was already sampled by Binaghi (1972).

- 31: north of Capoliveri, fast-flowing small brook, north of Il Casino, 15 m; PNAT, 15.IV.2004.
- 32: west of Porto Azzurro, brook with algae south of Casa Galletti (Valle di Puntecchio), 105 m; PNAT, 5.IV.2004.
- 33: Madonna Monserrato, north of Porto Azzurro, unpolluted brook, 70 m; 6.IV.1998, 18.IV.1998, 7.IV.1999.
- 34: east of Cima del Monte, Fosso di Acquaviva, brook close to small water reservoirs, 100 m; PNAT, 8.IV.1998.
- 35: south of Capoliveri, Fosso del Pontimento, rocky brook, Calamita peninsula, 166 m; 15.IV.1998, 14.IV.2004.
- 36: south of Capoliveri, Fosso del Pontimento, brook, Calamita peninsula, 300 m; PNAT, 16.IV.2001, 16.III.2003, 16.IV.2003.
- 37: south of Capoliveri, Fosso del Pontimento, small brook with *Isoetes* sp., Calamita peninsula, 325 m; PNAT, 4.IV.1999, 8.IV.1999, 16.IV.2000, 21.IV.2000, 27.IV.2000.
- 38: south of Monte Calamita, Fosso di Fosco, brook with both shallow and deep parts, Calamita peninsula, 235-240 m; PNAT, 24.IV.2000, 4.IV.2001, 14.IV.2001, 14.IV.2004, 28.III.2005.
- 39: south of Monte Calamita, Fosso di Salcio, well, Calamita peninsula, 330 m; PNAT, 16.IV.2003.
- 40: west of Monte Calamita, Fosso di Calestrone, small brook, Calamita peninsula, 360 m; PNAT, 22.IV.2000.
- 41: between Monte Calamita and Monte le Torricelle, Fosso di Monte Rotondo, Calamita peninsula, wet depressions near road, 330 m; PNAT, 22.IV.2000.
- 42: between Monte Calamita and Monte le Torricelle, area Serrone delle Rose, Calamita peninsula, wet depressions near road, 300 m; PNAT, 22.IV.2000.
- 43: northeast of Monte le Torricelle, small well with cold water, ditch, small brook west of Miniera di Sassi Neri, with algae, 50 m; PNAT, 12.IV.1998, 20.IV.2000, 31.III.2002, 6.IV.2004, 10.IV.2006.
- 44: north of Monte le Torricelle, south of Punta Nera, Calamita peninsula, slowly flowing ditch with algae, 46 m; PNAT, 6.IV.2004.
- 45: brook north of Monte le Torricelle, northeast of Miniera di Sassi Neri, 12 m; PNAT, 12.IV.1998.
- 46: granite stone pit with various water-filled depressions, west of San Piero in Campo, with *Typha*, *Iris*, *Hyla sarda* (de Betta, 1857) (Amphibia, Hylidae), many larvae of Ephemeroptera and Odonata, 275 m; PNAT, 29.III.2005.
- 47: small brook (Fosso Stabbiati) situated above locality 46, west of San Piero in Campo, 350 m; PNAT, 29.III.2005.
- 48: brook (Fosso Oltana, according to Lotti et al. (1885)) between San Piero in Campo and Seccheto, situated near Casa Moncione, 366 m; PNAT, 29.III.2005.
- 49: brook (Fosso Oltana, see locality 48), swamp and well between Pietra Murata and Piane del Canale (west of San Piero in Campo), 505 m; PNAT, 29.III.2005, 12.IV.2006, 20.IV.2006.



- 50: Fosso Malocci, brook with submerged steep rocks north of Seccheto, 548 m, PNAT, 20.IV.2006.
- 51: Fosso dell'Inferno, brook with submerged steep rocks north of Seccheto, 533 - 550 m; PNAT, 20.IV.2006.
- 52: Fosso del` Pratetto, brook with submerged steep rocks north of Seccheto, 250 m; PNAT, 14.IV.2006.
- 53: Western affluent of Fosso del Forno, small brook north of Fetovaia with *Hyla sarda* (Amphibia, Hylidae); 362 m; PNAT, 14.IV.2006.
- 54: Water filled granite depression south of Moncione, north of Cavoli, 310 m; PNAT, 12.IV.2006.
- 55: Small ditch, Castancoli, between Cavoli and San Piero in Campo, 250 m; PNAT, 12.IV.2006.
- 56: Fosso Marcianella, north of San Ilario in Campo, brook below a bridge, 214 m; PNAT, 19.IV.2006.
- 57: Fosso di Acquaviva, north of Porto Azzurro, brook with slow and fast-flowing areas, partly with *Chara spec.*, 75-80 m; PNAT, 11.IV.2006, 18.IV.2006.
- 58: Stone pit near Casa Buraccio, west of Porto Azzurro, pond with many *Hyla* sp. (Amphibia, Hylidae), *Rana* sp. (Amphibia, Ranidae) and Odonata larvae, 140 m; 17.IV.2006.
- 59: Mola plain, between Porto Azzurro and Capoliveri; slow-flowing and stagnant ditches with *Iris spec.*; 2 m; PNAT, 15.IV.2006.
- 60: Small ditches alongside a path north of Monte le Torricelle (Calamita Peninsula), 200 m; PNAT, 10.IV.2006.
- 61: Significantly polluted brook, northeast of Fattoria Ripalte (Calamita Peninsula), 170 m; PNAT, 10.IV.2006.
- 62: Fosso Reale, northeast of Porto Azzurro, brook, 50-70 m; 20.VII.1960, Binaghi leg. (Binaghi, 1961).
- 63: Fosso di Valdana, north of Golfo Stella, brook, 40-50 m; 18.VII.1960, Binaghi leg. (Binaghi, 1961).
- 64: Fosso di Campo ai Peri, north of Golfo Stella, brook, 60 m; 17.VII.1960, Binaghi leg. (Binaghi, 1961).
- 65: Fosso Galeo, Piana della Pila, 30 m; 14, 17 and 22.VII.1960, Binaghi leg. (Binaghi, 1961); same locality, except 50 m, 1.IX.1963, Pederzani leg. (Fery, 1991).
- 66: Fosso Redinoce, northeast of Monte Perone, 20-30 m; 14.VII.1960, Binaghi leg. (Binaghi, 1961).
- 67: Valle della Nivera, east of Poggio, 200-250 m; PNAT, 12.VII. and 14.VII.1960, Binaghi leg. (Binaghi, 1961).
- 68: Uviale di Marciana, southeast of Marciana Alta, 300 m; PNAT, 13.VII.1960, Binaghi leg. (Binaghi, 1961).
- 69: Uviale di Marciana, northwest of San Cerbone, 500 m; PNAT, 12.VII.1960, Binaghi leg. (Binaghi, 1961).
- 70: Fosso dell'Inferno, north of Seccheto, 30-100 m; PNAT, 23.VII.1960, Binaghi leg. (Binaghi, 1961).
- 71: Uviale di Marciana, 400-450 m; PNAT, 2.IX.1963, Pederzani leg. (Pederzani 1967; Fery & Brancucci, 1997).



Hydradeephaga from Elba Island. The Hydradeephaga species so far recorded from Elba Island by the author and by many colleagues (especially G. Binaghi, C. Holdhaus, F. Pederzani and S. Rocchi) are listed below. Faunistic and zoogeographical data are provided for each species, with special consideration for the Tuscan Archipelago, Corsica, Sardinia, mainland Tuscany - e.g. Macchia della Magona (Livorno province) and Maremma toscana (Grosseto province) (cf. Rocchi, 1984; Rocchi & Terzani, 2003) - and Latium. Zoogeographical data are mainly follow Angelini (1984), Franciscolo (1979), Vigna Taglianti et al. (1999) and Nardi & Maltzeff (2001). The total number of species collected during 1998-2006 is 39 (1.272 adults, 196 larvae). Additional first and second instar larvae, especially of the Hydroporinae could not be assigned to species.

The nomenclature used follows, unless otherwise specified, those of Vondel (1997, Haliplidae), Nilsson (2001, Dytiscidae), Dettner (1997, Noteridae) and Franciscolo (1979, Gyrinidae).

ABBREVIATIONS. LI = first instar larva/ae; LII = second instar larva/ae; LIII = third instar larva/ae; loc. = sampling site/s n.; x = adult/s.

### Haliplidae

#### 1. *Haliplus* (*Neohaliplus*) *lineatocollis* (Marsham, 1802) - 77 adults

MATERIAL EXAMINED. 16: 2 x (18.IV.2001); 2 x (2.IV.2002); 21 x (3.IV.2002). 17: 4 x (19.IV.2001). 18: 2 x (19.IV.2001); 2 x (29.III.2002); 2 x (19.IV.2006). 19: 2 x (29.III.2002). 30: 2 x (7.IV.2004); 1 x (2.IV.2005). 33: 2 x (6.IV.1998). 38: 2 x (14.IV.2001). 49: 5 x (20.IV. 2006). 57: 23 x (11.IV.2006); 5 x (18.IV.2006).

From Elba, this species was recorded by Holdhaus (1923) and Binaghi (1961: loc. 63 and 65). *Haliplus lineatocollis* is recorded also from Giglio, Capraia and Montecristo (cf. Gridelli, 1926; Pirisinu, 1976; Rocchi, 1980) among the islands of the Tuscan Archipelago. It is common in Maremma toscana (Rocchi, 1984), Macchia della Magona (Rocchi & Terzani, 2003), Sardinia (Burmeister et al., 1987) and Corsica (Rocchi, 1986). This West-Palaearctic species is recorded from all Italian regions (Franciscolo, 1979; Angelini, 1984).

#### 2. *Haliplus* (*Liaphlus*) *mucronatus* Stephens, 1829

From Elba, *H. mucronatus* was recorded by Binaghi (1961) at Fosso di Valdana (loc. 63) and by Rocchi (1980). It is a rare species in the Maremma toscana (Rocchi, 1984), Corsica (Rocchi, 1986) and Sardinia (Burmeister et al., 1987). *Haliplus mucronatus* is a Mediterranean species which is recorded from all Italian regions except Aosta Valley and Trentino-Alto Adige (cf. Angelini, 1984; Nardi & Maltzeff, 2001).

#### 3. *Haliplus* (*Liaphlus*) *flavicollis* Sturm, 1834

From Elba, *H. flavicollis* was recorded by Rocchi (1980). The species is abundant in the Maremma toscana (Rocchi, 1984) and has been recorded from Sardinia (Angelini, 1984). It shows a Centralasiatic-European distribution and is found all over Italy including the large islands (cf. Angelini, 1984; Nardi & Maltzeff, 2001).



4. *Haliphus (Liaphlus) fulvus* (Fabricius, 1801)

Rocchi (1980) recorded this species from Elba (without further details). This Holarctic species is recorded from northern Italy (except Aosta Valley), Tuscany, Umbria, Latium, Abruzzo and Sicily (cf. Angelini, 1984; Nardi & Maltzeff, 2001).

5. *Haliphus (Liaphlus) guttatus* Aubé, 1836 - 1 adult

MATERIAL EXAMINED. 16: 1 x (2.IV.2002).

One specimen was collected from a swamp near Marina di Campo and represents the first record for Elba. Rocchi (1980) recorded it from Giannutri. This West-Mediterranean and Balkan species is usually found in stagnant waters. It occurs throughout Italy (except Trentino-Alto Adige and Friuli-Venezia Giulia) including the large islands (cf. Nardi & Maltzeff, 2001). It is rare in the Maremma toscana (Rocchi, 1984), Corsica (Rocchi, 1986) and Sardinia (Burmeister et al., 1987).

## Dytiscidae

6. *Liopterus haemorrhoidalis* (Fabricius, 1787) - 108 adults

MATERIAL EXAMINED. 28: 3 x (15.IV.2004). 30: 3 x (4.IV.2002); 13 x (7.IV.2003); 8 x (15.IV.2003); 14 x (17.IV.2003); 18 x (19.IV.2003); 1 x (23.IV.2003); 5 x (25.IV.2003); 3 x (3.IV.2004); 16 x (15.IV.2004); 8 x (2.IV.2005). 59: 16 x (15.IV.2006).

This species is new for Elba, where it was found in the eastern part of the Mola plain. It was recently moved from *Copelatus* Erichson, 1832 to *Liopterus* Dejean, 1833 (Balke et al., 2004). *Liopterus haemorrhoidalis* is a Turano-European species which is found throughout Italy including the large islands (cf. Nardi & Maltzeff, 2001). In contrast, *L. atriceps* (Sharp, 1882) is a West-Mediterranean species known from Portugal, Spain, Corsica, Sardinia, mainland Italy (Latium and Campania), Sicily, Morocco, Algeria and Tunisia (cf. Nardi & Maltzeff, 2001).

The Elban specimens were compared to central European specimens of *L. haemorrhoidalis* and Sardinian specimens of *L. atriceps* because these species are closely related (cf. Nardi & Maltzeff, 2001) and belong to the same subgroup of species (Guignot, 1961). The slightly shorter (7-7.5 mm) *L. atriceps* is characterized also in possessing few short and fine metacoxal striolations, which are distinct and more abundant in the larger (7-8 mm) *L. haemorrhoidalis* (Guignot, 1961; Franciscolo, 1979). Moreover, the aedeagus of *L. atriceps* is larger than those of *L. haemorrhoidalis*.

7. *Laccophilus hyalinus testaceus* Aubé, 1837 - 39 adults

MATERIAL EXAMINED. 4: 2 x (19.IV.2000). 6: 2 x (6.IV.1999); 9 x (1.IV.2005). 7: 3 x (17.IV.1998). 9: 1 x (1.IV.1999). 22: 1 x (13.IV.2004); 2 x (13.IV.2004). 52: 3 x (14.IV.2006). 57: 8 x (11.IV.2006). 58: 8 x (17.IV.2006).

*Laccophilus hyalinus testaceus* was collected in eight localities of western, central and eastern Elba. In addition, it was recorded by Holdhaus (1923, as "*Laccophilus interruptus* Panz."), Binaghi (1961, as *L. testaceus*: loc. 65) and Rocchi (1980). It is known also from Giglio and Capraia (Rocchi, 1980). It is common at Macchia della Magona (Rocchi & Terzani, 2003), and common and widespread in facing mainland Tuscany (Rocchi,



1984). *Laccophilus hyalinus* (De Geer, 1774) is a Turano-Europeo-Mediterranean species (cf. Nardi & Maltzeff, 2001) and is found all over Italy including the large islands. In Italy, *Laccophilus hyalinus testaceus* is recorded from Piedmont, Liguria, Emilia-Romagna, the central and southern regions, Sicily and Sardinia (cf. Angelini, 1984).

#### 8. *Hyphydrus ovatus* (Linné, 1761)

The presence of *H. ovatus* on Elba was recorded by Rocchi (1980). This Sibero-European species is recorded from northern Italy (except Aosta Valley and Liguria), Tuscany and Latium (Angelini, 1984). From Tuscany, both its Italian congeners, *H. aubei* Ganglbauer, 1892 (included Giglio and Capraia) and *H. anatolicus* Guignot, 1957, are also recorded (cf. Angelini, 1984; Rocchi 2001).

#### 9. *Hydrovatus cuspidatus* (Kunze, 1818) - 14 adults

MATERIAL EXAMINED. 30: 1 x (15.IV.2003); 3 x (19.IV.2003); 2 x (23.IV.2004); 5 x (25.IV.2003); 1 x (30.VII.2004). 59: 2 x (15.IV.2006).

Several specimens were collected in the swamp of the Mola plain. The species was recorded by Rocchi (1980) for Elba and Giglio. *Hydrovatus cuspidatus* is common in the Maremma toscana (Rocchi, 1984), Corsica (Rocchi, 1986) and Sardinia (Angelini, 1984; Burmeister et al., 1987). It shows a Turano-Europeo-Mediterranean distribution and occurs throughout Italy including the large islands (Angelini, 1984; Nardi & Maltzeff, 2001). Biström (1996) synonymized *H. cuspidatus* and *H. simplex* Sharp, 1882.

#### 10. *Yola bicarinata* (Latreille, 1804)

This species was recorded from Elba by Binaghi (1961, as “*Yola bicarinata* ab. *obscurior* Desbr.”) at Fosso di Valdana (loc. 63) and Fosso Galeo (loc. 65), as well as by Rocchi (1980). In the Maremma toscana, *Yola bicarinata* is rare (Rocchi, 1984). It occurs in western Europe, north Africa and throughout Italy including the large islands (Franciscolo 1979; Angelini, 1984). “The dorsally darkened morph, *Y. b. obscurior* [(Desbrochers des Loges, 1871)], found in Corsica, Sardinia and Tunisia, has a limited distribution and thus satisfies the requirements for subspecific rank” (Biström, 1983: 36). This taxon is recorded also from Elba, but the opinion of Biström (1983) was ignored by several authors (e.g. Angelini, 1984; Rocchi, 1986; Burmeister et al., 1987; Angelini, 1993).

#### 11. *Bidessus saucius* (Desbrochers des Loges, 1872) - 5 adults

MATERIAL EXAMINED. 22: 2 x (13.IV.2004). 37: 2 x (8.IV.1999). 45: 1 x (12.IV.1998).

Five specimens of this species were collected in central and eastern Elba. Binaghi (1961) and Fery (1991) recorded a few other specimens from Fosso Galeo (loc.65). This Tyrrhenian species is protected by “allegati A and B delle Legge Regionale toscana n. 56/2000” due to its limited distribution (cf. Rocchi, 2001). *Bidessus saucius* occurs only on Corsica, Sardinia, Elba, Giglio, Capraia and Montecristo (Rocchi, 1986; Burmeister et al. 1987; Fery, 1991). According to Rocchi (1986) it is abundant in Corsica. Fery (1991) states that records from Liguria and Piedmont should be confirmed.



12. *Bidessus minutissimus* (Germar, 1824) - 2 adults

MATERIAL EXAMINED. 38: 2 x (14.IV.2001).

Apart from the two above-mentioned specimens, further Elban specimens were recorded by Binaghi (1961 loc. 63, 65 and 70). Older records were also reported by Holdhaus (1923) and Fery (1991: 1 x, 1908, Paganetti leg.). *Bidessus minutissimus* occurs in south, central and western Europe, northern Africa and the Canary Islands (Fery, 1991). In the central Mediterranean this species is recorded from Tunisia, southern France, Corsica, mainland Italy (Liguria, Piedmont, Lombardy, Tuscany and Latium), Sardinia, Elba, Giglio and Capraia (Rocchi, 1980; Fery, 1991). According to Fery (1991) southern Italian records possibly refer to *Bidessus calabricus* Guignot, 1957. In the Maremma toscana *B. minutissimus* is rare (Rocchi, 1984).

13. *Hydroglyphus geminus* (Fabricius, 1792) - 6 adults

MATERIAL EXAMINED. 25: 1 x (23.IV.2003). 30: 2 x (15.IV.2003). 49: 1 x (29.III.2005); 1 x (20.IV.2006). 57: 1 x (11.IV.2006).

This Palaearctic and often abundant species is found throughout Italy, including the large islands (Angelini, 1984, as *Guignotus pusillus* (Fabricius, 1781)). Apart from the above-mentioned Elban localities and an old record by Holdhaus (1923, as *Bidessus geminus*: G. Paganetti leg.), Rocchi (1980, as *G. pusillus*) reported *H. geminus* from Elba, Giglio, Capraia and Giannutri. In the Maremma toscana as in most other places, *H. geminus* is very common (Rocchi, 1984, as *G. pusillus*).

14. *Hygrotus (Coelambus) impressopunctatus* (Schaller, 1783) - 16 adults

MATERIAL EXAMINED. 30: 1 x (15.IV.2003); 1 x (19.IV.2003); 3 x (23.IV.2003); 3 x (25.IV.2003); 4 x (7.IV.2004); 4 x (2.IV.2005).

All the specimens of this species, which is new for Elba, were found in the swamp of the Mola plain. *Hygrotus impressopunctatus* is common in the Maremma toscana (Rocchi, 1984). This Holarctic species is found in northern (except Aosta Valley and Liguria) and central Italy (except Molise), Puglia and Sardinia (Angelini 1984; Burmeister et al., 1987, in both cases as *C. impressopunctatus*).

15. *Hydroporus pubescens* (Gyllenhal, 1808) - 8 adults

MATERIAL EXAMINED. 16: 7 x (18.IV.2001). 20: 1 x (14.IV.2001).

Apart from the above-mentioned localities from central Elba, the species was reported for Elba, Giglio, Capraia and Giannutri by Rocchi (1980). In facing mainland Tuscany - e.g. Macchia della Magona (Rocchi & Terzani, 2003) and Maremma toscana (Rocchi, 1984) - *H. pubescens* is rare to common. The species shows a Europeo-Mediterranean distribution and is found throughout Italy including the large islands (cf. Angelini, 1984; Nardi & Maltzeff, 2001). In Corsica and Sardinia it is very abundant (Rocchi, 1986; Burmeister et al., 1987).



16. *Hydroporus discretus* Fairmaire & Brisout de Barneville, 1859 - 3 adults

MATERIAL EXAMINED. 49: 1 x (12.IV.2006); 2 x (20.IV.2006).

This crenophilous species is new for Elba, where it is confined to a swamp west of San Piero in Campo. *Hydroporus discretus* is widespread in the Palaearctic region, from Portugal to East Siberia (cf. Nilsson, 2003). In Europe it is mainly a Mediterranean species that reaches Great Britain and southern Fennoscandia to the north (Nilsson & Holmen, 1995; Nilsson, 2003). This species is found all over Italy (except Molise and Puglia) but is most widespread in the northern regions (Franciscolo, 1979; Angelini, 1984). On the larger islands (Corsica, Sardinia and Sicily) *H. discretus* is rare and occurs between 550 and 1650 m (Rocchi, 1986; Burmeister et al., 1987; Gerecke & Brancucci, 1989). The Elban station is at 505 m a.s.l., an altitude which corresponds to those (about 520 m) at which this species occurs in central Europe (cf. Flechtner, 1986; Dettner & Moos, 2004).

17. *Hydroporus analis* Aubé, 1836

The species was recorded for Elba and Capraia by Rocchi (1980). *Hydroporus analis* is a West-Mediterranean species (Nilsson, 2003) recorded in Italy from Liguria, Emilia-Romagna, the central and southern regions, Sicily and Sardinia (Angelini, 1984). In Corsica (Rocchi, 1986) and Sardinia (Burmeister et al., 1987) the species is very abundant.

18. *Hydroporus jonicus jonicus* Miller, 1862 - 22 adults

MATERIAL EXAMINED. 26: 1 ♀ (5.IV.2004). 28: 2 ♀ ♀, 2 ♂ ♂ (15.IV.2004). 30: 2 ♀ ♀ (3.IV.2002); 1 ♀, 1 ♂ (4.IV.2002); 1 ♂ (15.IV.2003); 1 ♀, 3 ♂ ♂ (17.IV.2003); 2 ♂ ♂, 1 ♀ (25.IV.2003); 1 ♂ (7.IV.2004); 2 x (2.IV.2005). 59: 1 ♀, 1 ♂ (15.IV.2006).

*Hydroporus jonicus jonicus* is new for Elba, where it appears to be confined to the Mola plain. Gridelli (1926) and Rocchi (1980) recorded it from Giglio. In the Maremma toscana it is common (Rocchi, 1984). *Hydroporus jonicus* is an East-Mediterranean species (cf. Nardi & Maltzeff, 2001), which in Italy is recorded from Venetia, Friuli-Venezia Giulia, Emilia-Romagna, the central and Mediterranean regions (cf. Nardi & Maltzeff, 2001). The shape of the apical part of the aedeagus (cf. Angelini, 1978) is one of the few features allowing to distinguish *Hydroporus jonicus jonicus* from the Tyrrhenian (Corsica, Sardinia, Sicily, Tuscany, Latium, Campania, Calabria) *H. gridellii* Focarile, 1960 (cf. Nardi & Maltzeff, 2001), so the aedeagi of all Elban specimens were carefully examined. Females of both species cannot be distinguished (cf. Angelini, 1978; Franciscolo, 1979; Nardi & Maltzeff, 2001).

19. *Hydroporus tessellatus* (Drapiez, 1819) - 108 adults

MATERIAL EXAMINED. 7: 1 x (10.IV.2004). 16: 2 x (2.IV.2002). 18: 4 x (29.III.2002); 1 x (19.IV.2006). 20: 8 x (14.IV.2001); 1 x (11.IV.2006). 21: 2 x (13.IV.2004). 23: 21 x (13.IV.2004); 4 x (30.III.2005). 26: 1 x (3.IV.2004); 6 x (5.IV.2004). 27: 1 x (5.IV.2004). 28: 5 x (15.IV.2004). 30: 2 x (7.IV.2004); 1 x (2.IV.2005). 33: 1 x (6.IV.2004). 36: 8 x (16.IV.2001); 2 x (16.IV.2003). 38: 1 x (14.IV.2001). 40: 1 x (22.IV.2000). 43: 1 x (20.IV.2000); 9 x (6.IV.2004). 45: 5 x (12.IV.1998). 46: 2 x (29.III.2005). 47: 2 x (29.III.2005). 49: 2 x (29.III.2005); 1 x (12.IV.2006); 7 x (20.IV.2006). 57: 1 x (11.IV.2006). 58: 1 x (17.IV.2006). 59: 4 x (15.IV.2006).



The species is very abundant in all types of water throughout Elba. Further Elban records are those by Holdhaus (1923: Paganetti leg.) and Binaghi (1961: loc. 62, 67 and 68). According to Rocchi (1980), *H. tessellatus* is known from Elba, Giglio, Montecristo and Giannutri. This species is rare to common at Macchia della Magona (Rocchi & Terzani, 2003) or in facing localities of the Maremma toscana (Rocchi, 1984). This Mediterranean species reaches the Transcaucasus and Iran eastward (cf. Nilsson, 2003), and is found throughout mainland Italy and its large islands (cf. Nardi & Maltzeff, 2001).

#### 20. *Hydroporus obsoletus* (Drapiez) - 72 adults

MATERIAL EXAMINED. 2: 1 x (18.IV.2001). 6: 1 x (10.IV.2001). 21: 2 x (13.IV.2004). 23: 1 x (30.III.2005). 32: 2 x (5.IV.2004). 36: 8 x (16.IV.2001); 10 x (16.IV.2003). 37: 1 x (27.IV.2000). 38: 1 x (14.IV.2004). 39: 7 x (16.IV.2003). 40: 1 x (22.IV.2000). 41: 12 x (22.IV.2000). 43: 9 x (20.IV.2000); 6 x (6.IV.2004). 44: 4 x (6.IV.2004). 49: 1 x (20.IV.2006). 50: 1 x (20.IV.2006). 54: 1 x (12.IV.2006). 56: 2 x (19.IV.2006). 57: 1 x (18.IV.2006).

In western Europe, *Hydroporus obsoletus* is often a semisubterranean species (cf. Dettner & Moos, 2004). It is abundant in mountain areas of all parts of Elba. Furthermore, Binaghi (1961) collected *H. obsoletus* at Uviale di Marciana (loc. 69) and Rocchi (1980) reported it from Elba, Giglio and Capraia. This species is generally rare and was also found at Macchia della Magona (Rocchi & Terzani, 2003). *Hydroporus obsoletus* is a West-Mediterranean species, found from Madeira up to Ireland and Norway (cf. Dettner & Moos, 2004). In Italy, it is present from Liguria to Calabria, Sicily and Sardinia (Angelini, 1984; Burmeister et al., 1987). In southern Europe the species is chiefly montane (e.g. 800-1400 m in Corsica, above 500 m in Sardinia) (cf. Rocchi, 1986; Burmeister et al., 1987), whereas in northern Europe it is found at low altitudes or along coastal zones (Dettner & Moos, 2004).

#### 21. *Hydroporus memnonius* Nicolai, 1822 - 182 adults

MATERIAL EXAMINED. 16: 2 x (18.IV.2001); 2 x (2.IV.2002); 10 x (3.IV.2004). 17: 3 x (19.IV.2001). 18: 1 x (19.IV.2006). 19: 4 x (19.IV.2001). 24: 1 x (20.IV.2003). 25: 1 x (20.IV.2003); 3 x (23.IV.2003). 26: 5 x (5.IV.2004). 27: 15 x (5.IV.2004). 28: 24 x (15.IV.2004). 29: 6 x (14.IV.2004). 30: 1 x (3.IV.2002); 15 x (4.IV.2002); 5 x (15.IV.2003); 5 x (17.IV.2003); 6 x (25.IV.2003); 3 x (7.IV.2004). 36: 1 x (16.IV.2001). 43: 3 x (31.III.2002). 49: 6 x (29.III.2005); 1 x (12.IV.2006); 26 x (20.IV.2006). 59: 33 x (15.IV.2006).

This species is new for Elba, where it is abundant. However, all localities, except loc. 49 are situated in the central and eastern parts of the island. Apart from loc. 36 (300 m) and 49 (505 m) all localities are situated below 100 m. It is surprising that the most abundant *Hydroporus* Clairville, 1806 species on Elba was previously unknown there. Rocchi (1980) reported the species also from Giglio. *Hydroporus memnonius* is found throughout mainland Italy and its large islands (Angelini, 1984). In the Maremma toscana *H. memnonius* is rare (Rocchi, 1984). The shape and length of body and the ecology of this species are very variable (cf. Fery, 1999; Nardi, 2005). This is true also for the Elban specimens, although all Elban females show lengthened gonocoxae with a triangular appendix, a feature which is diagnostic for *H. memnonius* (Fery, 1999).



## 22. *Hydroporus limbatus* Aubé, 1836

Two specimens were recorded by Binaghi (1972) in a swamp of the Mola plain near Porto Azzurro (loc. 30). *Hydroporus limbatus* is common in the Maremma toscana (Rocchi, 1984). This West-Mediterranean species reaches also the Atlantic coasts of France and Morocco (cf. Angelini, 1984; Nilsson, 2003; Bennas & Sàinz-Cantero, 2006). In Italy, *H. limbatus* is known from Tuscany, Latium, Puglia, Calabria, Sicily and Sardinia (Angelini, 1984; Nardi, 2005).

## 23. *Rhithrodytes sexguttatus* (Aubé, 1836)

Rocchi (1980) reports this interesting species from Elba and Montecristo. This typical Tyrrhenian and montane species is abundant in Corsica (Rocchi, 1986) and Sardinia (Burmeister et al., 1987). Its distribution includes also one locality (Fornovolasco) in the Apuan Alps (Tuscany) (Angelini, 1984; Bameul, 1989), where it occurs together with *R. crux* (Fabricius, 1792) (Angelini, 1984). This localized species is protected by “allegati A delle Legge Regionale toscana n. 56/2000” (cf. Rocchi, 2001).

## 24. *Graptodytes varius* (Aubé, 1838) - 1 adult

MATERIAL EXAMINED. 22: 1 x (13.IV.2004).

One specimen was caught from central Elba. Binaghi (1961) recorded this species from five Elban localities: Fosso Reale (loc. 62), Fosso di Valdana (loc. 63), Fosso di Campo ai Peri (loc. 64), Fosso Galeo (loc. 65) and Fosso Redinoce (loc. 66). Rocchi (1980) reported it from Elba and Capraia. At Macchia della Magona *G. varius* is abundant (Rocchi & Terzani, 2003), whereas it is common but localized in the Maremma toscana (Rocchi, 1984). This is a Europeo-Mediterranean species (cf. Rocchi & Terzani, 2003) which is found in Corsica and throughout Italy including Sardinia (Burmeister et al., 1987) and Sicily (cf. Rocchi, 1986; Nardi & Maltzeff, 2001).

## 25. *Graptodytes fractus* (Sharp, 1882) - 20 adults

MATERIAL EXAMINED. 18: 1 x (19.IV.2006). 19: 1 x (19.IV.2001). 36: 5 x (16.IV.2001). 37: 9 x (4.IV.1999). 61: 4 x (10.IV.2006).

The species was found in central and eastern Elba. It was also reported from the island by Holdhaus (1923, as *Hydroporus fractus*), Binaghi (1961: loc. 62 and 63) and Rocchi (1980). The species occurs in southern France, northern Africa and many Italian regions (Piedmont, Emilia-Romagna, Tuscany, Marches, Latium, Abruzzi, Basilicata, Calabria, Sardinia, Sicily) (Rocchi, 2000). In the Maremma toscana it is rare (Rocchi, 1984) and a sole specimen was collected at Macchia della Magona (Rocchi & Terzani, 2003). In Sardinia (Burmeister et al., 1987) and Sicily (Gerecke & Brancucci, 1989), *Graptodytes fractus* is widely distributed and is found in small muddy waters and brooks which are drying up. Two of the above-mentioned Elban specimens are flattened and slightly larger (body length 2-2.1 mm) but belong to *G. fractus* and not to *G. aurasius* (Jeannel, 1907) or *G. ignotus* (Mulsant & Rey, 1861).



26. *Graptodytes bilineatus* (Sturm, 1835) - 45 adults, 29 larvae

MATERIAL EXAMINED. 15: 2 x (3.IV.2002). 16: 3 x (18.IV.2001); 21 x (2.IV.2002); 4 x (3.IV.2004). 25: 3 x (20.IV.2003); 3 x (23.IV.2003). 30: 2 x (3.IV.2002); 29 LIII (7.IV.2004); 1 x (23.IV.2004); 5 x (2.IV.2005). 59: 1 x (15.IV.2006).

The species, which is new for Elba, was found in all wet plains of the island (Schioparello/Le Prade, Mola, Campo). It is surprising that the currently most abundant *Graptodytes* Seidlitz, 1887 species on Elba was previously unrecorded, whereas it was recorded from Giglio by Rocchi (1980). *Graptodytes bilineatus* is very rare at Macchia della Magona (Rocchi & Terzani, 2003) and in the Maremma toscana (Rocchi, 1984). This Sibero-European species is found all over Italy except Marches (cf. Nardi & Maltzeff, 2001).

27. *Graptodytes concinnus* (Stephens, 1835)

Binaghi (1961, as *G. flavipes* (Olivier, 1795)) collected this species in two Elban localities: Fosso di Valdana (loc.63) and Fosso Galeo (loc. 65). Rocchi (1980) reported it for Elba and Capraia. *Graptodytes concinnus* is a South-European species which is rare in the Maremma toscana (Rocchi, 1984). In mainland Italy it is recorded from Piedmont, Liguria and the central and southern regions (cf. Nardi & Maltzeff, 2001). According to Burmeister et al. (1987), Gerecke & Brancucci (1989) and Rocchi (1986), this species occurs in many localities of Sardinia, Sicily and Corsica.

28. *Graptodytes granularis* (Linné, 1767) - 4 adults

MATERIAL EXAMINED. 17: 3 x (19.IV.2001). 28: 1 x (15.IV.2004).

This species is new to Elba, where it was collected in the plains of Mola and Campo. It was also found on Giglio (Rocchi, 1980) and is rare in the Maremma toscana (Rocchi, 1984). *Graptodytes granularis* shows a European distribution. It occurs in northern (except Aosta Valley and Liguria) and central Italy (cf. Nardi & Maltzeff, 2001).

29. *Stictonectes optatus* (Seidlitz, 1887) - 142 adults, 34 larvae

MATERIAL EXAMINED. 5: 4 x (5.VI.2004); 2 x (18.IV.2003); 1 x (1.IV.2005). 6: 2 x (1.IV.2005). 8: 2 x (17.IV.1998). 11: 12 x (7.IX.1997). 13: 4 x (13.IV.1998). 22: 42 x (13.IV.2004). 33: 17 x (6.IV.1998); 11 x (7.IV.1999); 4 LII, 13 LIII (6.IV.1998). 34: 2 x (7.IV.1999). 36: 2 x (16.IV.2001); 1 x (16.III.2003). 37: 1 x (4.IV.1999); 1 x (16.IV.2000); 8 x (27.IV.2000); 2 LI, 6 LII, 4 LIII (8.IV.1999); 2 LI, 1 LII, 2 LIII (21.IV.2000). 38: 3 x (14.IV.2001). 53: 5 x (14.IV.2006). 57: 16 x (11.IV.2006); 6 x (18.IV.2006).

This species, which is characteristic of brooks, is known from all parts of Elba, where it is common. It was recorded from Elba also by Holdhaus (1923, as “*Hydroporus lepidus* Ol.”: Paganetti leg.), Binaghi (1961: loc. 63, 65-67), Rocchi (1980) and Grasso (1984: Marciana, 24.VI.1973, 6 x; Marciana, 350 m, 18.IX.1979, Poggi leg., 10 x). *Stictonectes optatus* is also present on Giglio, Capraia and Montecristo (Rocchi, 1980; Grasso, 1984). At Macchia della Magona the species is rare to abundant (Rocchi & Terzani, 2003), whereas it is rare in the Maremma toscana (Rocchi, 1984). *Stictonectes optatus* is a West-Mediterranean species which lives in brooks. It is present in the western part of Italy, from Liguria down



to Sicily (Angelini 1978; Franciscolo 1979; Angelini, 1984; Grasso, 1984), and is very abundant in Sardinia (Burmeister et al., 1987) and Corsica (Rocchi, 1986).

30. *Deronectes angelinii* Fery & Brancucci, 1997 - 1 adult

MATERIAL EXAMINED. 6: 1 x (6.IV.1999).

Apart from the above-mentioned specimen from the southern slope of Monte Capanne, some specimens of this rare species were recorded from the northern slope of Monte Capanne in the western part of Elba. Pederzani (1967, as *D. latus* (Stephens, 1829)) and Fery & Brancucci (1997) recorded five specimens from Uvale di Marciana (loc. 71), and Fery & Brancucci (1997) recorded two males from Marciana (24.VI.1973, N. Sanfilippo leg.). *Deronectes angelinii* is an Italian endemic which is known from Piedmont, Lombardy, Liguria, Emilia-Romagna, Tuscany (Viareggio, Pontremoli, Palazzuolo sul Senio, Elba), Latium, Campania, Basilicata, Calabria and Sicily (Fery & Brancucci, 1997; Rocchi, 2000).

31. *Deronectes moestus inconspectus* (Leprieur, 1876) - 16 adults, 29 larvae

MATERIAL EXAMINED. 5: 3 x (18.IV.2003). 6: 2 x (18.IV.2003). 18: 1 x (19.IV.2006). 19: 1 x (19.IV.2001). 24: 3 x, 2 LI, 11 LII, 16 LIII (20.IV.2003). 31: 1 x (15.IV.2004). 34: 2 x (8.IV.1998). 57: 3 x (11.IV.2006).

Apart from the southeastern part of island (Calamita peninsula), this species was found throughout Elba. All Elban specimens belong to *D. moestus inconspectus*, although H. Fery checked them and stated that they are intermediate between *D. moestus moestus* (Fairmaire, 1858) and *D. moestus inconspectus*. Moreover, two specimens with a slightly broadened, excavated prosternal process actually belong to *D. moestus inconspectus* and not to *D. fairmairei* (Leprieur, 1876), a species which is also present in northern Tuscany (Rocchi, 2001). Further Elban records are those of Holdhaus (1923, as “*Hydroporus moestus* Fairm.”), Binaghi (1961, as *D. moestus*: loc. n. 62-65), Pederzani (1967, as *D. moestus*: loc. 71) and Fery & Brancucci (1997: loc.71, “Ins. Elba 1908” and “Marciana Alta, VI.1973, leg. Pederzani”). Rocchi (1980, as *D. moestus*) reported *D. moestus inconspectus* from Elba, Giglio and Montecristo.

This taxon is rare to common at Macchia della Magona (Rocchi & Terzani, 2003) and in the Maremma toscana (Rocchi, 1984). In contrast to *D. moestus moestus*, which is endemic to Corsica and Sardinia (Fery & Brancucci, 1997), *D. moestus inconspectus* shows a West-Mediterranean distribution; in Italy it is recorded from all mainland regions except Aosta Valley and Friuli-Venezia Giulia and from Sicily (cf. Angelini, 1984; Fery & Brancucci, 1997).

32. *Stictotarsus procerus* (Aubé, 1838) - 1 adult, 1 larva

MATERIAL EXAMINED. 6: 1 ♀, 1 LIII (19.IV.2000).

Recently, Mazzoldi & Toledo (1998) provided a key to the species closely related to *S. duodecimpustulatus* (Fabricius, 1792) and compiled their general distributions. Although most diagnostic characters are found in the males (protibiae, protarsal claws, aedeagus and parameres) both sexes of *S. duodecimpustulatus* and *S. procerus* may be se-



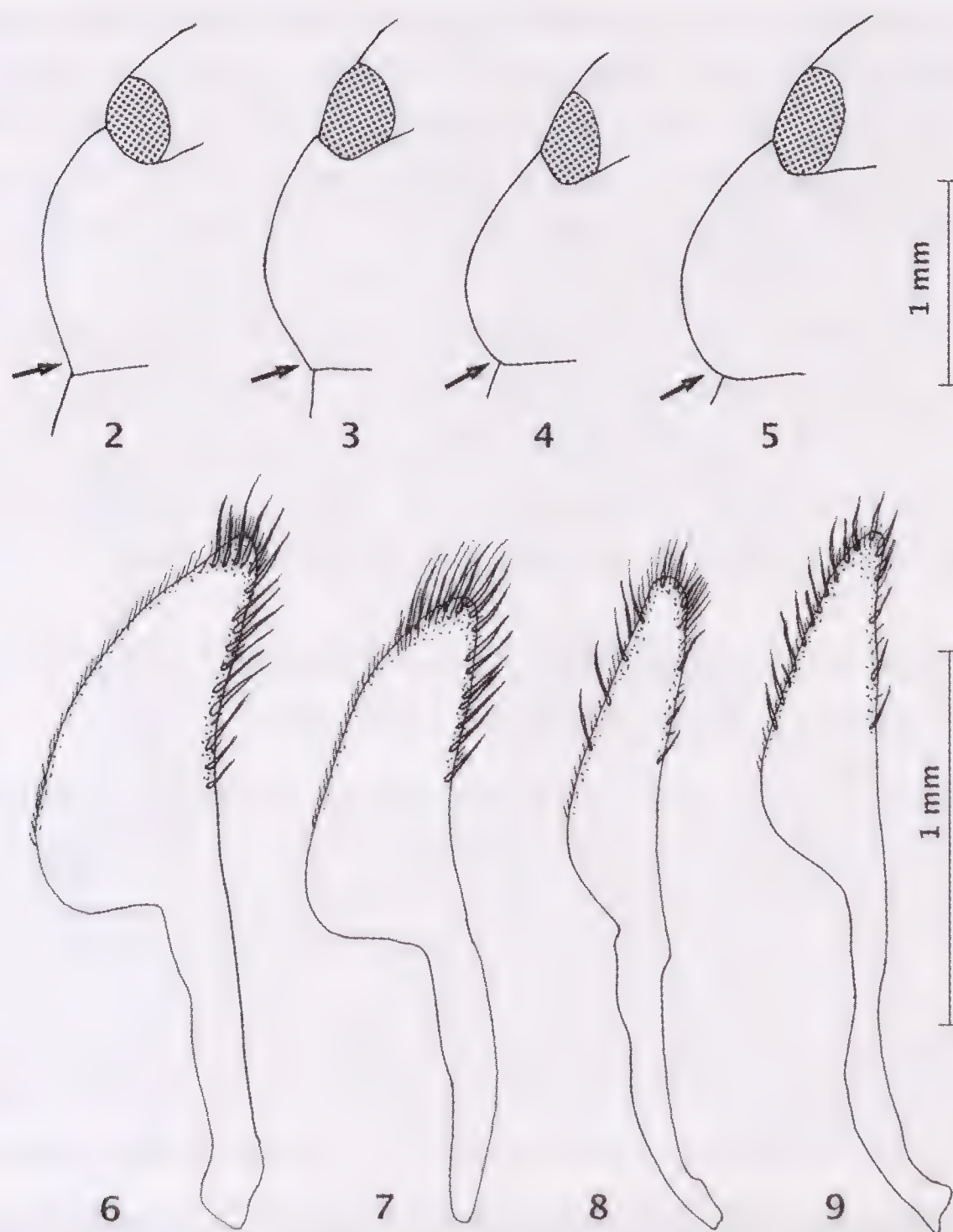


Fig. 2-9. Females of *Stictotarsus* species: 2 - pronotal border of *S. duodecimpustulatus* from Gönningen (Germany); 3 - ditto from the northern Pyrenees (France); 4 - pronotal border of *S. procerus* from Fosso Barione (Elba Island); 5 - ditto from Rocca Doria (Sardinia); 6 - gonocoxa of *Stictotarsus duodecimpustulatus* from Gönningen (Germany); 7 - ditto from the northern Pyrenees (France); 8 - gonocoxa of *S. procerus* from Fosso Barione (Elba Island). 9 - ditto from Rocca Doria (Sardinia). Arrows indicate rounded or angled pronotal bases.

parated by the shape of pronotal base, which is more or less regularly rounded in *S. procerus* and angled in *S. duodecimpustulatus*. The sole Elban adult specimen (a female) was identified as *S. procerus* by comparing the shape of its pronotum (fig. 4) and gonocoxae (fig. 8) with those of specimens of *S. procerus* from Sardinia (figs 5, 9) and of *S. duodecimpustulatus* from Germany (figs 2, 6) and France (figs 3, 7). The Elban specimen showed an overall pronotal shape similar to that of *S. procerus* from Sardinia. In addition both specimens from Elba and Sardinia showed similar shapes of gonocoxosternites (Franciscolo, 1979 fig. 1269) and gonocoxae (see also Mazzoldi & Toledo, 1998). The gonocoxae are an unequivocal character to determine *S. procerus* (figs 8-9), and *S. duodecimpustulatus* (figs 6-7); obviously, captions to figures 1272 and 1273 of Franciscolo (1979) must be exchanged: 1272 = *S. duodecimpustulatus*, 1273 = *S. procerus*. From the same Elban locality, a third stage hydroporine larva with swimming hairs and the *Stictotarsus* colour pattern on pronotum was collected and attributed to *S. procerus*.



*Stictotarsus procerus* is new for Elba and Tuscany. According to Mazzoldi & Toledo (1998) and Bennas & Sàinz-Cantero (in press), this species is recorded from Corsica, Sardinia, Sicily, southern Italy (Alburni mountains in Campania and Satriano in Basilicata, both records previously referred to *S. duodecimpustulatus*), northern Morocco and northern Tunisia, whereas records from Algeria need confirming. The record of *S. duodecimpustulatus* from central and southern Italy should be checked (see Mazzoldi & Toledo, 1998) in order to define the distributional border between both species in central Italy. For example, *S. duodecimpustulatus* is a rare species in the Maremma toscana (Rocchi, 1984) and also occurs in the surroundings of Rome (Nardi & Maltzeff, 2001). Due to its general rarity (cf. Rocchi, 1986; Burmeister et al., 1987, Gerecke & Brancucci, 1989), *S. procerus* should be incorporated in the Red List of Tuscan Insects.

33. *Agabus* (“*Metronectes*”) *aubei* (Perris, 1869) – 10 adults, 4 larvae

MATERIAL EXAMINED. 10: 4 LIII (10.IV.2004); 10 x (12.IV.2006).

*Agabus* (“*Metronectes*”) *aubei* is a Corso-Elban mountain endemic. This very rare species is known from several Corsican localities, especially between 1000 and 1800 m, and was characterized as belonging to the “faune torrenticole”, which also comprises *Hydroporus regularis* Sharp, 1882 and *Agabus cephalotes* Reiche, 1861 (see Balke et al., 1997). In Corsica, *A. aubei* occurs on steep wet rocks covered by the endemic *Narthecium reverchonii* (Liliaceae). Both larvae and adults live within wet mats between the rocky ground and the plant’s roots.



Fig. 10-14. Dorsal view of larvae of *Agabus* (“*Metronectes*”) *aubei*: 10 - LIII from Fosso dei Mallocci (Elba); 11 - ditto; 12 - LIII from Lac de Melo (Corsica); 13 - LII from Lac de Melo (Corsica); 14 - LI from Lac de Melo (Corsica).



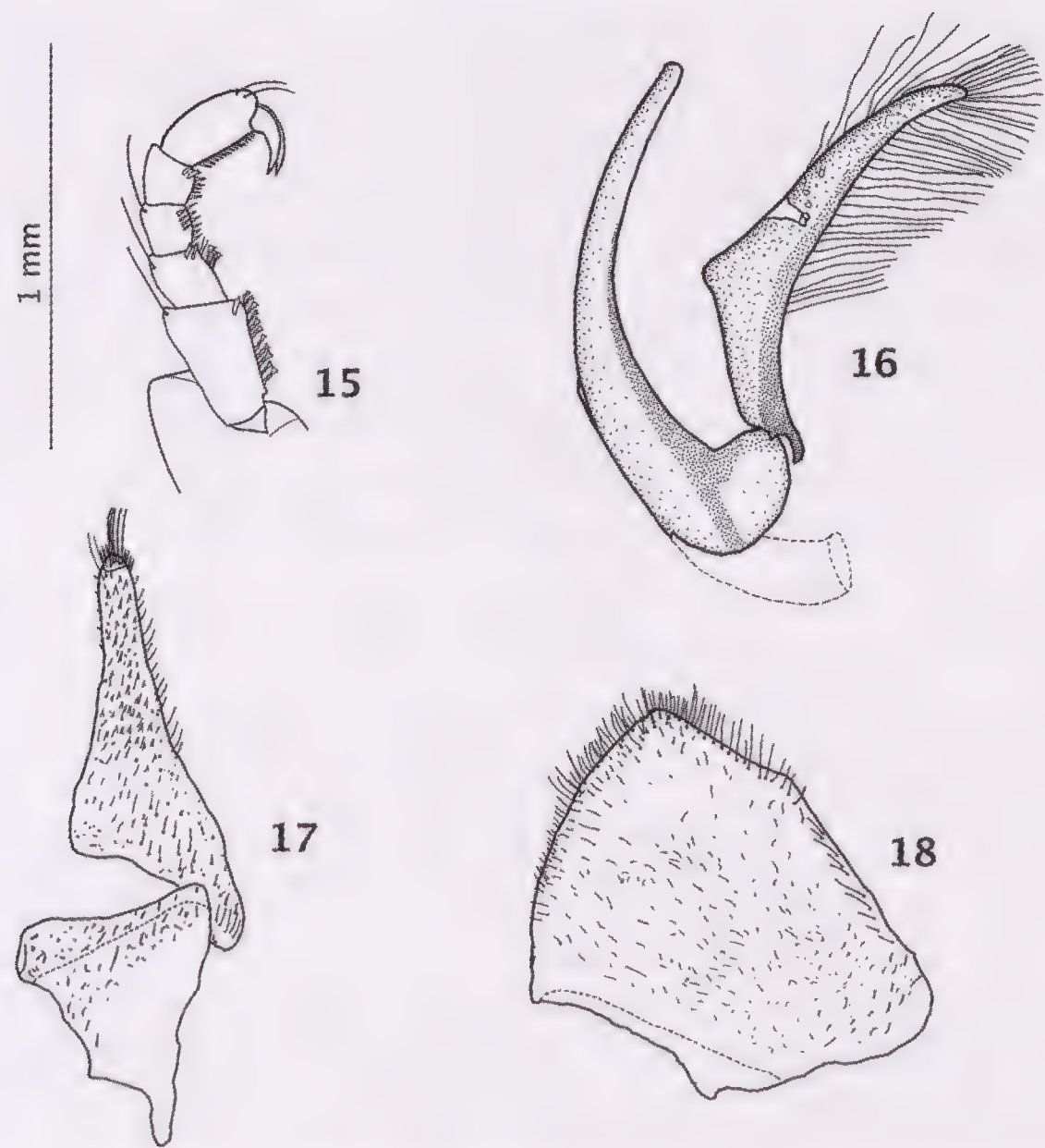


Fig. 15-18. Morphology of Elban specimens of *Agabus* (“*Metronectes*”) *aubei*: 15 - protarsi and claws of a male; 16 - aedeagus and paramere; 17 - gonocoxa and tergal half IX; 18 - gonocoxosternite.



Fig. 19. *Agabus* (“*Metronectes*”) *aubei* from Elba (photo by E. Helldörfer).



On Elba, this highly interesting species, which probably belongs to the *Dichonectes* Guignot, 1945 subgenus, is very rare and was recorded a few times from the same area. Holdhaus (1923) reports that one specimen was collected by E. Moczarski in the surroundings of Marciana. In addition, Franciscolo (1979, as *Metronectes aubei*) states that G. P. Moretti collected the species on 28.VII.1956 in a small brook (Rio di Marciana) at Marciana Alta. The most recent record of *A. aubei* dated back to 1963 (loc. 71: Uviale di Marciana, 2.IX.1963, at about 450 m) and was provided by Pederzani (1967), who found one specimen, together with *Deronectes angelinii* and *D. moestus inconspectus*, in fresh and clear water of a shaded brook situated in a chestnut grove.

According to Rocchi (2001, as *Metronectes aubei*), due to the small size of the Elban population, the degree of threat to *Agabus aubei* is considerable. Therefore, it is protected by “allegati A and B delle Legge Regionale toscana n. 56/2000” (cf. Rocchi, 2001).

The confirmed presence of this rare and enigmatic species on Elba is of high interest. Four larvae (figs 10-11) were found between wet roots forming a dense texture covering the granitic surface. When these roots were removed, the larvae were able to cling with their long claws onto the rocky surface in spite of the fast flowing water. Only under those roots which were overflowed by water was *A. aubei* caught successfully. Neither the central nor the extremely peripheral areas of the brook contained significant numbers of specimens, which might be due to the fact that central water areas are deeper and characterized by a stronger current; on the other hand smaller peripheral water films show significantly higher temperatures, low current, and seem to dry out during the summer months. All sites with *A. aubei* were characterized by the presence of the strong-smelling and hairy *Mentha aquatica* (Labiatae) and *Berula erecta* (Umbelliferae). When the same place was visited again one year later (29.III.2005), neither larvae nor adults of this rare species were observed. However, in 2006 ten adults of *A. aubei* were found at the same place. Search for further adults at other potential localities were unsuccessful. Adults showed a very rapid crawling behaviour on wet solid surfaces. It is astonishing that they are able to adhere to the bottom surface without being not swept away, because the hindlegs of *A. aubei* have only a few natatorial setae (cf. Balke et al., 1997). Adults of this species cannot swim but adhere to the water surface and if disturbed show thanatosis for several minutes. If the beetles reach roots of submersed plants, they quickly crawl away and hide. In the laboratory and under artificial light, males and females of *A. aubei* are capable of flight. Results of recent mitochondrial DNA sequencing (Ribera et al., 2004), based on cytochrome oxydase I (Ribera et al., 2001) show, in accordance with Balke et al. (1997), that specimens of *A. aubei* from Corsica represent the sister group of the *Agabus guttatus* group. Adults are characterized by their short thickened antennae, fine metacoxal lines and their shining surface. Their characteristic outer appearance and morphology (fig. 19) has been described by several authors (Zimmermann, 1934; Guignot, 1947; Franciscolo, 1979; Balke et al., 1997; Rocchi, 2001). It is interesting that the first pro- and mesotarsomeres of males lack ventral adhesive setae (fig. 15) as in other members of the *Agabus guttatus* group. In addition, fore claws of males are without teeth and are shorter than those of females (cf. Foster & Bilton, 1997). Fig. 16 shows the aedeagus and paramere; the aedeagus lacks an apical ventral denticle at the apex which occurs in other species of the *Agabus guttatus* group (Ribera et al., 2001). Female genitalia of *A. aubei* (figs 17-18) are here figured for the first time (cf. Franciscolo, 1979; Balke et al., 1997).



All larval instars of *Agabus* (“*Metronectes*”) *aubei* are characterized by their stout and broad appearance (figs 10-14), as well as by their short and broad legs (Balke et al., 1997). In addition, they possess short urogomphi and a broad head capsule with a rectangular area between neck and temporal angle (see Balke et al., 1997). No morphological differences were observed between the larvae from Elba (figs 10-11) and those from Corsica (figs 12-14); the differences in colour between these larvae are due only to alcoholic preservation.

Franciscolo (1957) recorded this species also from Sicily (Madonie, Palermo, Pignano della Battaglia, VII.1951, leg. M. Mariani), although he later recognized his determination as wrong (Franciscolo, 1979).

#### 34. *Agabus brunneus* (Fabricius, 1798) - 45 adults

MATERIAL EXAMINED. 3: 2 ♀♀ (25.IV.2000). 4: 1 ♀ (25.IV.2000). 5: 1 ♀ (6.IV.1999); 1 ♀ (19.IV.2000). 3 ♀♀, 2 ♂♂ (18.IV.2003); 5 ♀♀, 3 ♂♂ (1.IV.2005). 6: 2 ♀♀, 2 ♂♂ (10.IV.2001); 1 ♂ (26.III.2002). 18: 1 ♀, 2 ♂♂ (19.IV.2006). 22: 1 ♂, 1 ♀ (13.IV.2004). 33: 1 ♂ (18.IV.1998); 2 ♀♀ (7.IV.1999). 35: 1 ♂ (8.IV.1999). 37: 3 ♀♀, 2 ♂♂ (8.IV.1999). 38: 1 ♀ (24.IV.2000); 1 ♀ (28.III.2005). 48: 1 ♀ (29.III.2005). 53: 2 ♀♀ (14.IV.2006). 57: 1 ♀, 1 ♂ (11.IV.2006); 1 ♀ (18.IV.2006).

Recently, Millán & Ribera (2001) recognized that the Mediterranean species “*Agabus brunneus*” consists of a complex of three closely related species: *A. ramblae* Millán &

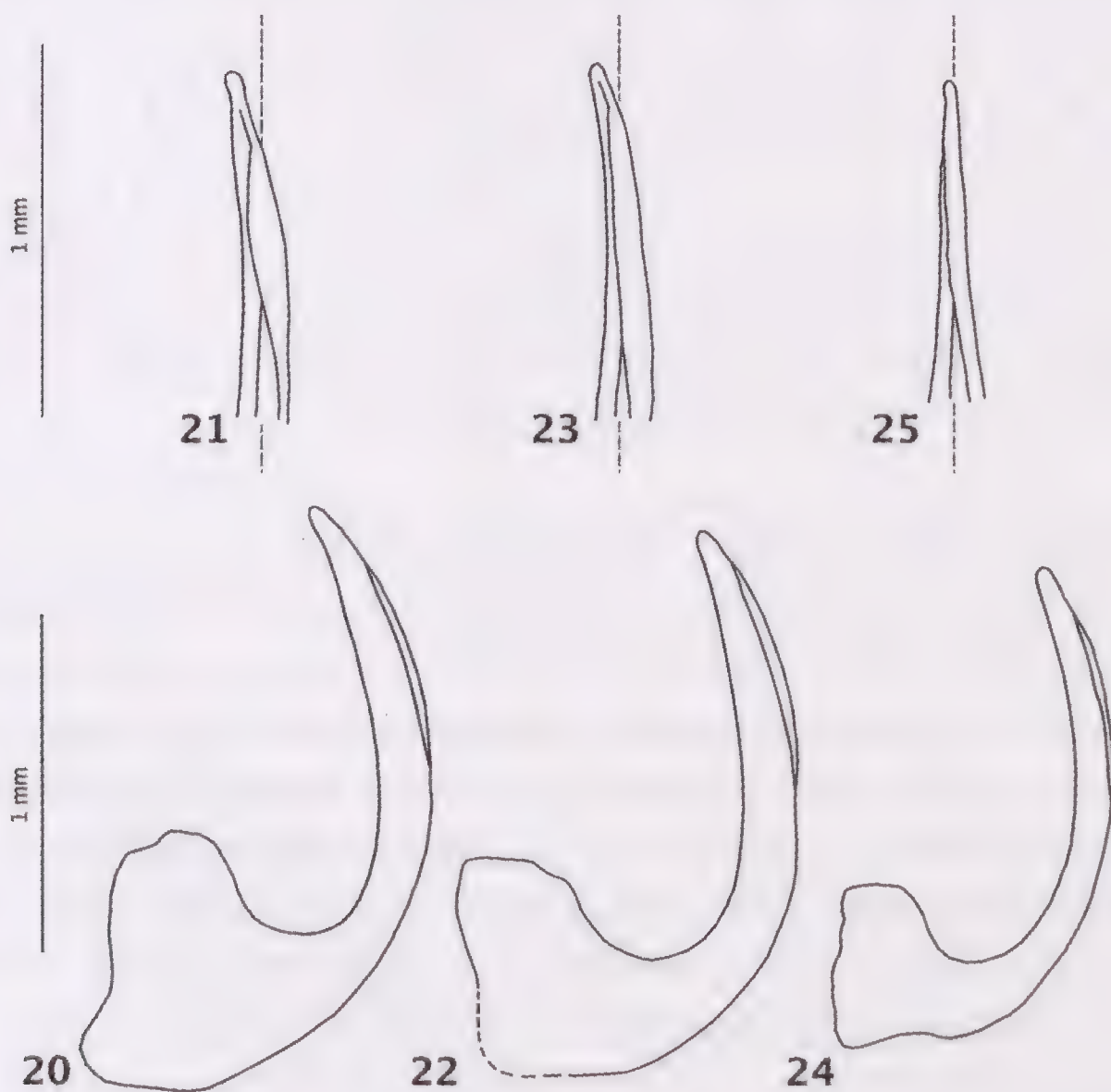


Fig. 20-25. *Agabus brunneus* and *A. rufulus*: 20 - aedeagus in lateral view of *A. brunneus* from Massif des Maures (southern France); 22 - ditto from Fosso della Porterogna (Elba); 24 - aedeagus in lateral view of *A. rufulus* from Villanova Strisaili (Sardinia); 21 - tip of aedeagus of *A. brunneus* from Massif des Maures (France); 23 - ditto from Fosso della Porterogna (Elba); 25 - tip of aedeagus of *A. rufulus* from Villanova Strisaili (Sardinia).



Ribera, 2001 (eastern Spanish mainland and Balearic Islands), *A. rufulus* Fairmaire, 1859 (Corsica and Sardinia) and *A. brunneus* Fabricius, 1798 sensu stricto (western Europe and northern Africa). These species are chiefly distinguished by the shape of the aedeagus and molecular characters (cf. Millán et al., 1997; Millán & Ribera, 2001).

All 29 males from 12 localities from the western, central and eastern parts of Elba were assigned to *A. brunneus*, after comparison of *A. rufulus* from Sardinia (Monte Limbara, Lago de Coghinas and Monti del Gennargentu, Villagrande di Strisaili) (figs 24-25) and *A. brunneus* from southern France (figs 20-21). Males of *Agabus brunneus* are characterized by dorsally strongly asymmetrical, wide and long aedeagi, whereas aedeagi of *A. rufulus* are narrow, less asymmetrical and slightly shorter. Millán et al. (1997) also examined three specimens from Elba (Fosso Barbone [sic!, recte Barione] near Pomonte, 29.V.1994, M. Toledo leg.) and noted that their status was not clear but that they were not identical to the species later described as *A. ramblae*. Now, the study of new material from Fosso Barione (loc. 6) and other parts of Elba shows that all male specimens from this island show the same strongly asymmetrical, wide and shorter aedeagi as *A. brunneus* (figs 22-23) and therefore are neither identical to *A. rufulus* nor to *A. ramblae*.

Binaghi (1961) collected this running-water species at Fosso Reale (loc. 62) and at Uviale di Marciana (loc. 64). The species is rare in Maremma toscana (Rocchi, 1984), whereas it is common at Macchia della Magona (Rocchi & Terzani, 2003) and on Giglio island, where it was present all year round (Gridelli, 1926; Rocchi, 1980). *Agabus rufulus* seems to be abundant and widespread in Sardinia (Burmeister et al., 1987, as *A. brunneus*) and Corsica (Rocchi, 1986, as *A. brunneus*), whereas *A. brunneus* is recorded from all Italian regions except Aosta Valley, Friuli-Venezia Giulia and Sardinia (cf. Angelini, 1984; Millán & Ribera, 2001). However, more studies are needed to examine the whole Mediterranean material of this species-complex. Due to its characteristic appearance and ferruginous colour, many specimens from different localities in the past were neither recorded systematically nor closely examined.

### 35. *Agabus didymus* (Olivier, 1795) - 18 adults, 42 larvae

MATERIAL EXAMINED. 18: 2 x (19.IV.2001); 2 x (29.III.2002); 21 LI/LIII, 21 LIII (29.III.2002); 9 x (19.IV.2006). 19: 4 x (19.IV.2001). 57: 1 x (11.IV.2006).

All specimens were taken in brooks situated in the Campo plain (loc. 18 and 19) and north of Porto Azzurro (loc. 57). The species was already reported for Elba (Franciscolo, 1979; Rocchi, 1980). *Agabus didymus* is rare to common at Macchia della Magona (Rocchi & Terzani, 2003) and in the Maremma toscana (Rocchi, 1984). This Europeo-Mediterranean species is recorded from all Italian regions (Angelini, 1984). In Sardinia it is widespread and common (Burmeister et al., 1987), whereas Rocchi (1986) recorded a sole locality for Corsica.

### 36. *Agabus binotatus* Aubé, 1836 - 135 adults

MATERIAL EXAMINED. 1: 2 x (18.IV.2001). 2: 1 x (18.IV.2001). 4: 2 x (25.IV.2000). 5: 5 x (19.IV.2000); 3 x (18.IV.2003); 1 x (1.IV.2005). 6: 1 x (10.IV.2001). 8: 1 x (17.IV.1998). 11: 6 x (7.IX.1997). 12: 1 x (13.IV.1998). 22: 4 x (13.IV.2004); 1 x (30.III.2005). 33: 1 x (6.IV.1998). 34: 2 x (8.IV.1998).



35: 1 x (15.IV.1998); 2 x (14.IV.2004). 36: 10 x (16.IV.2001); 26 x (16.III.2003). 37: 11 x (4.IV.1999); 3 x (8.IV.1999); 7 x (16.IV.2000); 6 x (27.IV.2000). 38: 2 x (4.IV.2001). 39: 5 x (16.IV.2003). 40: 2 x (22.IV.2000). 43: 7 x (20.IV.2000); 4 x (6.IV.2004); 2 x (10.IV.2006). 44: 3 x (6.IV.2004). 46: 2 x (29.III.2005). 47: 1 x (29.III.2005). 50: 1 x (20.IV.2006). 51: 3 x (20.IV.2006). 53: 2 x (14.IV.2006). 56: 4 x (19.IV.2006).

This characteristic species is found in brooks between 46 and 620 m in all parts of Elba, where it is abundant. Elban records were compiled from Holdhaus (1923) to Rocchi (1980), who also reported the species from Giglio, Capraia and Montecristo. Two specimens were additionally recorded by Pederzani & Schizzerotto (1998) from Elba (Marciana Alta, VI.1973, Pederzani leg., 1 ♀) and Giglio (Campese, 6.VIII.1959, Pederzani leg., 1 ♂). *Agabus binotatus* is rare in the Maremma toscana (Rocchi, 1984) and only one specimen was collected at Macchia della Magona (Rocchi & Terzani, 2003). The species is typical and abundant in mountainous areas of Sardinia (Burmeister et al., 1987: above 500 m), Corsica (Rocchi, 1986: between 800 and 2000 m) and Sicily (see Franciscolo, 1979). Ribera et al. (2001) suggest, according to molecular data, a continental origin of *A. binotatus*, followed by a colonisation of the Mediterranean islands. As stated by these authors, the species seems too young to have originated as a Corsican or Sardinian endemic by vicariant speciation.

The determination of adults of the *guttatus-biguttatus* group (= former subgenus *Dichonectes* Guignot, 1945) was done using Franciscolo (1979), Foster & Bilton (1997), Pederzani & Schizzerotto (1998) and Ribera et al. (2001). The pronotum in most species has an anterior row of punctures broadly interrupted in the middle. The first two pro- and mesotarsomeres of males are somewhat thickened and with ventral adhesive setae. Most species of this group live in mountain streams.

*Agabus binotatus* and *A. africanus* Pederzani & Schizzerotto, 1998 have a single series of setae on the ventral side of the first metatarsomere, as well as pale brown elytra with small and light microreticulation and punctation in both sexes. The remaining species of the group have two series of setae on the ventral side of the first metatarsomere. Nevertheless, the second row of setae of the first metatarsomere in single specimens of *A. biguttatus* (Olivier, 1795), *A. dilatatus* (Brullé, 1832) and *A. guttatus* (Paykull, 1798) can be absent or reduced to 1-2 setae. These specimens can be identified by examination of the elytral microreticulation and punctation, the shape of the male fore claws and the aedeagus.

The males of *A. alexandrae* Ribera, Hernando & Aguilera, 2001, *A. biguttatus*, *A. maderensis* Wollaston, 1854 and *A. nitidus* (Fabricius, 1801) have dentate fore claws and lack an apical ventral denticle at the apex of the aedeagus. Males of the remaining species (*A. dilatatus*, *A. guttatus*, *A. heydeni* Wehncke, 1872 and *A. picotae* Foster & Bilton, 1997) show unmodified fore claws and a distinct, shallow ventral tooth at the apex of aedeagus.

The palpi and antennae of *A. dilatatus* (body length 7.8-8.0 mm) lack darkened tips, and the elytral epipleura are paler and light brown testaceous. All other species of the group are characterized by dark elytral epipleura.

A thick aedeagus, exceeding 1.4 mm from its tip to the furthest part of the inner side is typical of *A. guttatus*. In the northern Apennines, besides *A. guttatus guttatus* (body length 7.5-9.3 mm), a small-sized (6.3-7.3 mm) subspecies also occurs: *A. guttatus baudii* Seidlitz, 1887 (cf. Pederzani, 1991; Rocchi, 2000). A narrower, smaller aedeagus (between



1.1 and 1.2 mm from its tip to the furthest part of the inner side) is typical of the Iberian sister species *A. heydeni* (body length 7.0-7.5 mm) and *A. picotae* (body length 8.2-8.6 mm).

Finally, *A. cephalotes* Reiche, 1861, a large carabiform species (body length 9.2-10.3 mm) endemic of Corsican mountains has the maximum width of pronotum before its middle. The remaining species are not carabiform and have a pronotum which is broadest at or behind its middle.

### 37. *Agabus biguttatus* (Olivier, 1795) - 5 adults

MATERIAL EXAMINED. 19: 3 x (19.IV.2001). 22: 1 x (30.III.2005). 24: 1 x (20.IV.2003).

On Elba this Centralasiatic-Europeo-Mediterranean (cf. Rocchi & Terzani, 2003) running-water species is rare and was found at low altitudes. Further records are those of Razzauti (1919: San Martino), Binaghi (1961: loc. 62 and 65) and Pederzani & Schizzerotto (1998: Marciana Alta, VI.1973, Pederzani leg.). One specimen was collected at Macchia della Magona (Rocchi & Terzani, 2003). *Agabus biguttatus* was found near Vizzavona in Corsica, at an altitude of 1400 m (Rocchi, 1986) and in Sardinia from low to high altitudes (Burmeister et al., 1987). According to Franciscolo (1979) and Angelini (1984), the species is distributed all over Italy.

### 38. *Agabus guttatus guttatus* (Paykull, 1798) - 13 adults

MATERIAL EXAMINED. 2: 2 x (18.IV.2001). 4: 1 x (25.IV.2000). 6: 1 x (10.IV.2001). 8: 3 x (17.IV.1998). 10: 1 x (12.IV.2006). 12: 1 x (13.IV.1998). 14: 3 x (13.IV.1998). 33: 1 x (7.IV.1999).

This species, which is widespread in Europe and reaches Turkey, west Siberia and Himachal Pradesh eastwards (Nilsson, 2003), is new for Elba, where it was usually found between 300 and 678 m on the Capanne massif. This corresponds to its occurrence in relation to altitude (850 m) in central Europe (cf. Flechtner, 1986; Dettner & Moos, 2004). *Agabus guttatus guttatus* usually co-occurs with *A. binotatus*. From the eastern part of the island there is only one record, from Madonna Monserrato (loc. 33). This running-water species, which also occurs in cold wells, is present all over Italy including Sicily (Angelini, 1984; Gerecke & Brancucci, 1989); in Sardinia it is known only from a swamp near Badde Sálighes (Nuoro province) at 860 m (Burmeister et al., 1987). A subspecies from the northern Apennines was described as *Agabus guttatus baudii* Seidlitz, 1887 (cf. Pederzani, 1991).

### 39. *Agabus bipustulatus* (Linné, 1767) - 37 adults, 9 larvae

MATERIAL EXAMINED. 16: 1 x (3.IV.2002). 18: 9 LIII (29.III.2002); 1 x (19.IV.2006). 19: 7 x (19.IV.2001). 23: 6 x (13.IV.2004). 30: 1 x (25.IV.2004). 36: 1 x (16.IV.2001). 41: 1 x (22.IV.2000). 43: 3 x (20.IV.2000). 49: 1 x (29.III.2005); 5 x (12.IV.2006); 8 x (20.IV.2006). 55: 2 x (12.IV.2006).

This ubiquitous species is known from western, central and eastern Elba. Binaghi (1961) recorded it from Fosso Redinoce (loc. 66) and Franciscolo (1979) from Marciana marittima. Rocchi (1980) reported it for Elba, Giglio and Capraia. The species is common at Macchia della Magona (Rocchi & Terzani, 2003) and in the Maremma toscana (Rocchi, 1984). *Agabus bipustulatus* is a Palaearctic species which is found all over Italy, including the islands (Angelini, 1984).



40. *Ilybius pederzanii* (Fery & Nilsson, 1993) - 13 adults

MATERIAL EXAMINED. 16: 2 x (18.IV.2001). 17: 3 x (19.IV.2001). 18: 3 x (19.IV.2001); 1 x (19.IV.2006). 19: 4 x (19.IV.2001).

The species, which was formerly placed within the genus *Agabus* Leach, 1817 (cf. Aradottir & Angus, 2004), is new for Elba, where is confined to the plain situated north of Marina di Campo. According to Fery & Nilsson (1993), Rocchi (2000) and Nardi & Maltzeff (2001), this Italian endemic occurs in western Italy (Liguria, Emilia-Romagna, Tuscany, Umbria, Marches, Latium, Abruzzi, Campania, Puglia, Basilicata and Calabria), whereas records from Corsica are doubtful. In addition, *I. montanus* (Stephens, 1828), a closely related species, was recorded from Corsica, Sardinia and Sicily (Fery & Nilsson, 1993), whereas *I. pseudoneglectus* (Franciscolo, 1972) is restricted to eastern Italy and the Balkan peninsula. On the facing Tuscan coasts (Rocchi 1984, as *Agabus melanocornis* Zimmermann, 1915. Rocchi & Terzani, 2003) *Ilybius pederzanii* is rare.

41. *Colymbetes fuscus* (Linné, 1758) - 1 adult, 2 larvae

MATERIAL EXAMINED. 30: 1 x (15.IV.2003); 1 LII, 1 LIII (23.IV.2003).

The Elban records of this species are from the Mola plain and Fosso Galeo (loc. 65) in the plain north of Marina di Campo (Binaghi, 1961). Rocchi (1980) reports the species from Elba and Giglio. This is a common species in the Maremma toscana (Rocchi, 1984). *Colymbetes fuscus* is a Centralasiatic-Europeo-Mediterranean species (cf. Nardi & Maltzeff, 2001), which occurs in all mainland Italian regions (except Aosta Valley), Sicily (Franciscolo 1979; Angelini 1984), Sardinia (Burmeister et al., 1987: 18 localities) and Corsica (Rocchi, 1986: Portovecchio). The West-Mediterranean *Colymbetes schildknehti* Dettner, 1983, which was also recorded from Sardinia, Sicily and Latium (Dettner, 1983a; Nardi & Maltzeff, 2001) has not yet been found on Elba.

42. *Melanodytes pustulatus* (Rossi, 1792) - 1 adult, 19 larvae

MATERIAL EXAMINED. 15: 2 LII (3.IV.2002). 16: 1 LIII (3.IV.2002), 1 LIII (18.IV.2004). 17: 1 LII, 2 LIII (19.IV.2001). 25: 1 x, 1 LII (20.IV.2003). 30: 3 LIII (23.IV.2003); 7 LIII (7.IV.2004). 59: 1 LIII (15.IV.2006).

This species is here first recorded for Elba, where it was found in the Mola, Schioparello/Le Prade and Campo plains. Franciscolo (1979) and Rocchi (1980) mentioned this species also for Giglio. In the Maremma toscana it is very rare (Rocchi, 1984). Data on the distribution of this transionic species were compiled by Focarile (1960) and Franciscolo (1979). In the central Mediterranean, *M. pustulatus* is recorded for Italian mainland (Emilia-Romagna, the central, except Umbria, and southern regions), Sicily, Sardinia (Angelini, 1984) and Corsica (Rocchi, 1986).

43. *Rhantus (Rhantus) suturalis* (MacLey, 1825) - 3 adults, 4 larvae

MATERIAL EXAMINED. 30: 1 x (15.IV.2003); 1 x, 3 LIII (17.IV.2003); 1 x, 1 LIII (25.IV.2003).

The species is new for Elba and was found in the Mola plain. Rocchi (1980, as *R. pulverosus* (Stephens, 1828)) recorded it for Giglio and Giannutri. In the Maremma toscana



it is common (Rocchi, 1984, as *R. pulverosus*). *Rhantus suturalis* is a subcosmopolitan species (cf. Nilsson, 2003), which is found throughout Italy including the large islands (Angelini, 1984, as *R. pulverosus*).

44. *Meladema coriacea* Laporte, 1835 - 14 adults, 18 larvae

MATERIAL EXAMINED. 4: 6 x (6.IV.1999). 5: 1 LIII (5.VI.2004), 1 LIII (18.IV.2003); 2 x (1.IV.2005). 8: 2 LI (17.IV.1998). 11: 4 x (7.IX.1997). 13: 2 LIII (13.IV.1998). 22: 2 LI (13.IV.2004). 33: 2 LI, 1 LII (6.IV.1998); 1 LII, 2 LIII (18.IV.1998), 38: 1 LIII (14.IV.2004); 2 x (28.III.2005). 45: 1 LIII (12.IV.1998). 48: 1 LI (29.III.2005). 52: 1 LI (14.IV.2006).

*Meladema coriacea* was found in western, central and eastern Elba. Further records are those of Razzauti (1919: Marciana) and Binaghi (1961: loc. 62). Rocchi (1980) reports this running-water species from Elba, Giglio, Capraia and Montecristo. This species is rare to abundant at Macchia della Magona (Rocchi & Terzani, 2003) and is rare in the Maremma toscana (Rocchi, 1984).

*Meladema coriacea* is a Mediterranean species which in Italy is recorded from Liguria, Tuscany, Marches, Latium, Molise, southern regions, Sardinia and Sicily (cf. Angelini, 1984. Nardi & Maltzeff, 2001). Based on mitochondrial DNA sequences from 16S ribosomal RNA and cytochrome oxidase I genes, *Meladema* specimens from 22 populations were recently analyzed by Ribera et al. (2003). These authors recognized that the Corsican populations of *Meladema coriacea* are distinctly separated from a large uniform group including *M. lanio* (Fabricius, 1775), *M. imbricata* (Wollaston, 1871) and populations of *M. coriacea* from northern Africa, the Canary Islands, Spain (including Mallorca) and southern France. For the Mediterranean area, Ribera et al. (2003) suggest that *M. coriacea* may have colonized Corsica during the early Pleistocene on a single occasion, whereas Mallorca would have been colonized recently on multiple occasions. It would be highly interesting to compare molecular data of *M. coriacea* specimens from Sardinia, Elba or the Italian peninsula with populations from southern France or Corsica.

45. *Hydaticus* (*Guignotites*) *leander* (Rossi, 1790) - 2 adults

MATERIAL EXAMINED. 30: 1 x (17.IV.2003); 1 x (23.IV.2003).

This species is new for Elba. Two adults were found in the Mola plain together with adults and larvae of *H. seminiger* (De Geer, 1774). In addition, Rocchi (1980) reported *H. leander* from Giglio. In the Maremma toscana it is common (Rocchi, 1984). *Hydaticus leander* is an Afrotropico-Mediterranean species, which is found in mainland Italy southwards from Venetia and Liguria. It also occurs in Corsica, Sardinia and Sicily (Angelini, 1984).

46. *Hydaticus* (*Hydaticus*) *seminiger* (De Geer, 1774) - 8 adults, 2 larvae

MATERIAL EXAMINED. 30: 1 x (17.IV.2003); 1 LIII (23.IV.2003); 6 x; 1 LI (25.IV.2003); 1 x (7.IV.2004).

This species is firstly recorded for Elba, on the basis of eight adults and two larvae (cf. Dettner, 1984) from the Mola plain. *Hydaticus seminiger* is rare in the Maremma toscana (Rocchi, 1984). This Sibero-European species is found all over Italy including Sardinia (cf. Nardi & Maltzeff, 2001).



47. *Dytiscus circumflexus* Fabricius, 1801

From Elba the species was reported by Binaghi (1961: loc. 65) and Rocchi (1980). One specimen was recorded from Macchia della Magona (Rocchi & Terzani, 2003). In the Maremma toscana, *Dytiscus circumflexus* is common but localized (Rocchi, 1984). This Turano-European-Mediterranean species occurs throughout Italy (except Trentino-Alto Adige and Venetia) and the large islands (cf. Angelini, 1984; Nardi & Maltzeff, 2001).

## Noteridae

48. *Noterus clavicornis* (De Geer, 1774) - 8 adults

MATERIAL EXAMINED. 30: 3 x (15.IV.2003); 5 x (23.IV.2003).

Only one locality in the Mola plain is known for this species. Rocchi (1980) reported it for Elba, Giglio and Capraia. *Noterus clavicornis* is very common in the Maremma toscana (Rocchi, 1984). It is a Centralasiatic-European species, which is found throughout mainland Italy, Sicily, Sardinia and Corsica (cf. Rocchi, 1986; Dettner 1997; Nardi & Maltzeff, 2001).

49. *Noterus crassicornis* (O. F. Müller, 1776)

This species was reported for Elba by Rocchi (1980). *Noterus crassicornis* shows a Sibero-European distribution and is found throughout Italy (except Aosta Valley, Friuli-Venezia Giulia, mainland Tuscany, Marches, Molise, Puglia and Sardinia). It is absent in Corsica but was reported from Sicily (cf. Franciscolo 1979; Angelini 1984; Dettner, 1997; Nardi & Maltzeff, 2001).

## Gyrinidae

50. *Gyrinus (Gyrinus) urinator* Illiger, 1807 - 72 adults, 3 larvae

MATERIAL EXAMINED. 6: 18 x (6.IV.1999); 2 x (10.IV.2001); 3 x (26.III.2002); 3 x (18.IV.2003); 6 x (1.IV.2005). 8: 6 x (17.IV.1998). 24: 2 x (20.IV.2003). 33: 1 x (6.IV.1998). 35: 1 x (15.IV.1998). 45: 3 x (12.IV.1998). 51: 2 x (20.IV.2006). 57: 6 x (11.IV.2006); 3 LIII (11.IV.2006); 19 x (18.IV.2006).

The species was found on all parts of Elba Island. In addition, it was recorded by Razzauti (1919: Saline di Portoferraio), Holdhaus (1923) and Binaghi (1961: loc. 65 and 66). Rocchi (1980) reported it from Elba, Giglio, Capraia and Montecristo. *Gyrinus urinator* is common in the Maremma toscana (Rocchi, 1984) and very common at Macchia della Magona (Rocchi & Terzani, 2003). This Mediterranean species, which is known also from Canary Islands, western Europe and some eastern European countries, is recorded in Italy from all regions except Aosta Valley and Trentino-Alto Adige (cf. Angelini, 1984; Nardi & Maltzeff, 2001).

51. *Gyrinus (Gyrinus) dejeani* Brullé, 1832

From Elba the species was recorded by Razzauti (1919: San Martino) and Binaghi (1961: loc. 65 and 66). Rocchi (1980) reported it from Elba, Giglio and Giannutri. *Gyrinus dejeani* is rare in the following Italian mainland areas: Macchia della Magona (Rocchi



& Terzani, 2003), Maremma toscana (Rocchi, 1984) and Latium (Nardi & Maltzeff, 2001). This Mediterranean species is found also in the Canary Islands and reaches Anatolia and Levant eastwards (cf. Angelini, 1984; Nardi & Maltzeff, 2001). In Italy, it is present in Lombardy, Liguria, and the central and southern regions including the large islands (cf. Nardi & Maltzeff, 2001).

## DISCUSSION

Zoogeographical remarks. Altogether, 51 hydradephagan species (38 of which collected by the author between 1998 and 2006) from at least 71 localities are currently known from the largest island of the Tuscan Archipelago. Fifteen species are reported for the first time: *Haliphus guttatus*, *Liopterus haemorrhoidalis*, *Hygrotus impressopunctatus*, *Hydroporus jonicus jonicus*, *H. memnonius*, *H. discretus*, *Graptodytes bilineatus*, *G. granularis*, *Stictotarsus procerus*, *Agabus guttatus guttatus*, *Ilybius pederzani*, *Melanodytes pustulatus*, *Rhantus suturalis*, *Hydaticus leander* and *H. seminiger*. *Stictotarsus procerus* is newly recorded for Tuscany and it is recommended that this species be incorporated into the Red List of Tuscan Insects. The presence of the Tyrrhenian species *Agabus* (“*Metronectes*”) *aubei* is confirmed (as larvae and adults) for the first time since 1963.

The few Tyrrhenian Dytiscidae from Elba mentioned by Holdhaus (1924) as typical mountainous species (*Graptodytes fractus*, *Agabus aubei*, *A. binotatus*) were expected to be restricted to higher altitude localities of western Elba. However, this applies only to *Agabus aubei*, which is found around Marciana in the north and in the neighbourhood of Seccheto (loc. 10) in the south. The habitats of loc. 52 and 56 in western Elba, and loc. 38 in eastern Elba, which are comparable to those of loc. 10, were carefully investigated, but neither adults nor larvae of this rare species were found. Many larvae (LI-LIII) of Elban Agabini were also studied, none of which belonged to *Agabus aubei*. Both *Agabus binotatus* and *Graptodytes fractus* occur in all parts of Elba, and in no case were they dominant at higher altitudes in the Capanne area.

It is remarkable that the dorsally darkened *Yola bicarinata obscurior* has been reported only from Elba (two low-altitude localities), Corsica, Sardinia and Tunisia (see species n. 10).

It seems possible that a careful search in the mountainous area, especially of western Elba (Monte Capanne and surroundings), and during other seasons, might reveal further species such as *Agabus cephalotes* Reiche, 1861, *Deronectes lareynii* Fairmaire, 1858 and *Hydroporus regularis*, all endemic of Corsican mountains (Rocchi, 1986), between 1200 and 1970 m, 700 and 1970 m, and 1200 and 1970 m a.s.l., respectively (Rocchi, 1986; Fery & Brancucci, 1997) and *H. sardomontanus* Pederzani, Rocchi & Schizzerotto, 2004, a Sardinian endemic occurring between 950 and 1550 m a.s.l. (Dettner 1983b, as *H. regularis*; Burmeister et al., 1987, as *H. regularis*; Pederzani et al., 2004). Possibly, other Tyrrhenian Dytiscidae (cf. Franciscolo, 1979; Burmeister et al., 1987) may occur on Elba: *Hydroporus gridellii* (see species n. 18), *Scarodytes nigriventris* (Zimmermann, 1919), *Stictonectes rufulus* (Aubé, 1838) and *Nebrioporus martinii* (Fairmaire, 1858). The species most likely still to be found on Elba are those occurring on the neighbouring islands of the Tuscan Archipelago (Rocchi, 1980: e.g. *Hygrobia hermanni* (Fabricius, 1775), *Hy-*



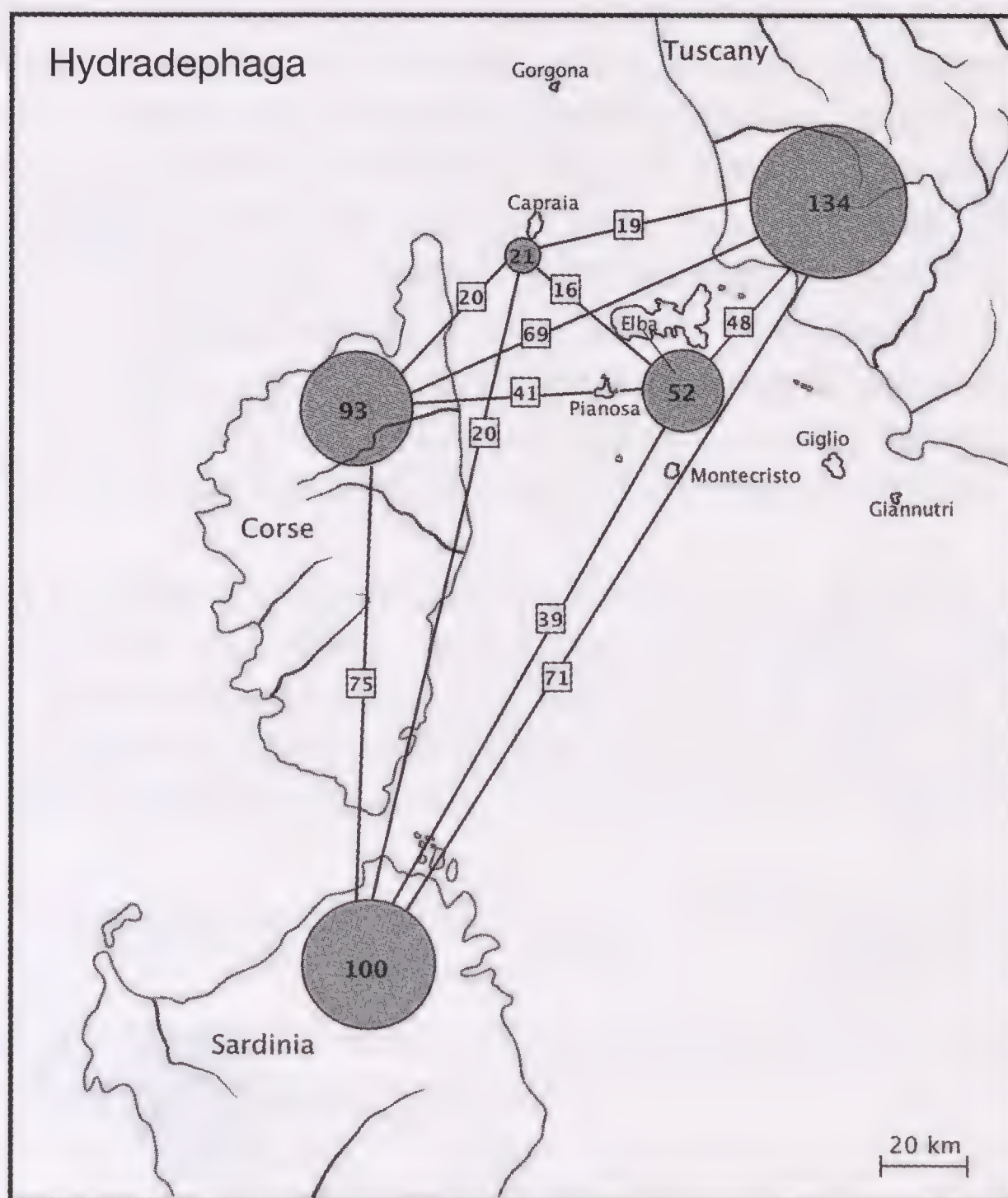


Fig. 26. Comparison of the hydradeephagan species' numbers of Sardinia, Corsica, Elba, Capraia and Tuscany. Numbers and circle diameters indicate species numbers; boxed numbers indicate species in common between two localities.

*hydrus aubei* (see species n. 8), *Hygrotus inaequalis* (Fabricius, 1777), *Laccophilus minutus* (Linné, 1758), *L. poecilus* Klug, 1834, *Agabus nebulosus* (Forster, 1771), *Gyrinus colymbus* Erichson, 1837), or those which are more or less common in the Maremma toscana (Rocchi, 1984: e.g. *Haliphus ruficollis* (De Geer, 1774), *H. variegatus* Sturm, 1834, *Hygrotus parallelogrammus* (Schaller, 1783), *Scarodytes halensis* (Fabricius, 1787), *Nebrioporus ceresyi* (Aubé, 1838), *Agabus conspersus* (Marsham, 1802), *A. nebulosus* (Forster, 1771), *Gyrinus substriatus* Stephens, 1829) or occur in other adjacent areas (*Liopterus atriceps* (see species n. 6), *Colymbetes schildknehti* (see species n. 41), *Ilybius meridionalis* Aubé, 1837, *Cybister lateralimarginalis* (De Geer, 1774), *Dytiscus pisanus* Laporte, 1835, *Eretes griseus* (Fabricius, 1781) (cf. Angelini, 1984; Maltzeff & Nardi, 2001; Miller, 2002), *Stictotarsus duodecimpustulatus* (see species n. 32), *Deronectes fairmairei* (see species n. 31)).

Species known from adjacent mainland areas of Tuscany or Latium could reach Elba by flight. The hydradeephagan fauna of an island like Elba is expected to be constituted by a high fraction of species able to fly, especially those found in the wetlands (e.g. Campo, Mola). The following species, already recorded from Elba, are capable of flying: *Haliphus*



*lineatocollis*, *Liopterus haemorrhoidalis*, *Laccophilus hyalinus testaceus*, *Hydroglyphus geminus*, *Hydroporus pubescens*, *H. jonicus jonicus*, *H. obsoletus*, *H. memnonius*, *Graptoodytes concinnus*, *Agabus aubei*, *Agabus biguttatus*, *A. bipustulatus*, *Colymbetes fuscus*, *Melanodytes pustulatus*, *Rhantus suturalis*, *Hydaticus leander*, *Dytiscus circumflexus*, *Noterus clavicornis* and *Gyrinus urinator* (Angelini 1998; Nardi & Maltzeff, 2001; S. Kehl, unpublished data). If one considers that *Bidessus delicatulus* (Schaum, 1844), *Stictonectes lepidus* (Olivier, 1795) and partly also *Stictotarsus duodecimpustulatus* are capable of flying, the same could be true for the closely related species *Bidessus minutissimus*, *Stictonectes optatus* and *Stictotarsus procerus*. In contrast, only a few of the species recorded for Elba are flightless: *Deronectes angelinii* (*D. latus* is flightless), *Agabus guttatus* and *Noterus crassicornis*.

Studies on several taxa of invertebrates and vertebrates found on Elba or other islands of the Tuscan Archipelago (cf. Favilli et al., 1995), have shown the possibility to compare species numbers on these islands with the paleogeography of the whole area, considering potential connections of the islands to the Italian peninsula and surrounding land masses (e.g. Giusti, 1976; Taiti & Ferrara, 1989). For example, Taiti & Ferrara (1989)

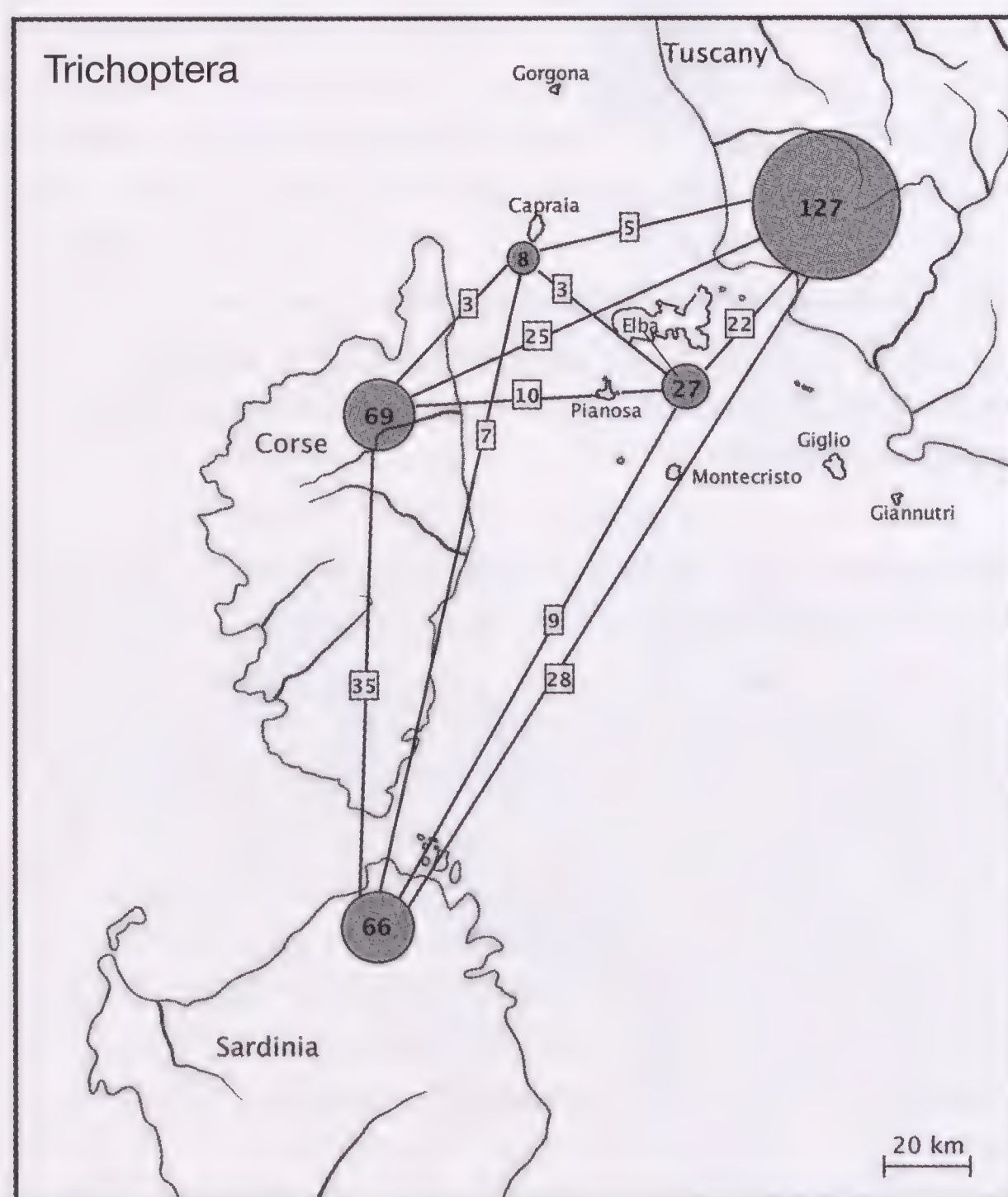


Fig. 27. Comparison of the trichopteran species' numbers of Sardinia, Corsica, Elba, Capraia and Tuscany according to Moretti & Cianficconi (1981). Numbers and circle diameters indicate the number of species. Boxed numbers indicate species in common between two localities.



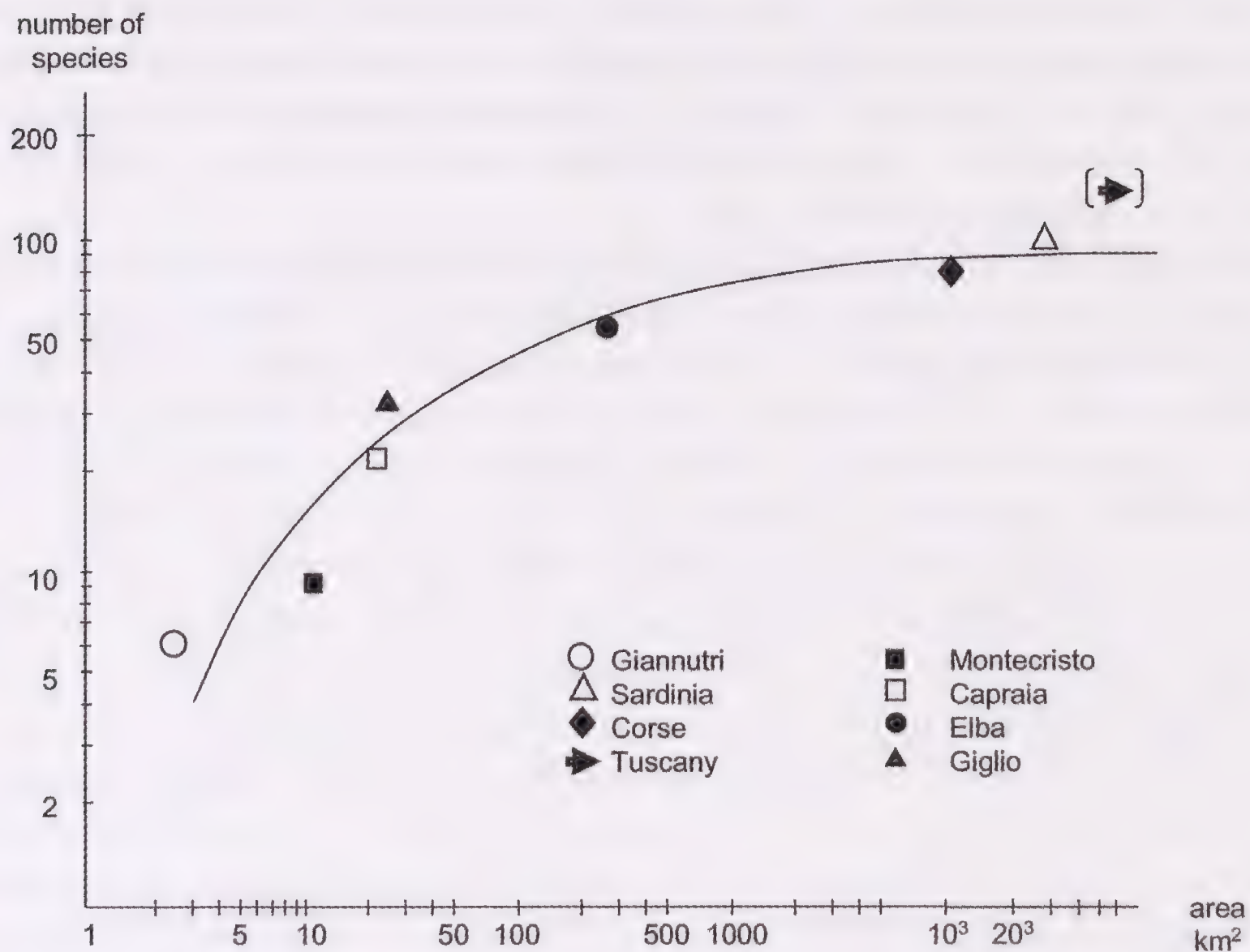


Fig. 28. Numbers of hydradephagan species of Corsica, Sardinia, islands of the Tuscan Archipelago and Tuscany, compared with surface areas (km<sup>2</sup>).

recorded 65 species of terrestrial Oniscoidea (Crustacea, Isopoda) from the Tuscan Archipelago and calculated a ratio between Alpine-Apennine (AA) and Tyrrhenian species (T). The ratio AA/T is 1/29 in Corsica, 1/5 in the Tuscan Archipelago, 1/2 in the coastal Tuscan hills (e.g. Livorno, Piombino, Orbetello) and reaches 13/1 in the Apennines (e.g. Arezzo). Of the 48 species of Tenebrionidae (Coleoptera) known from the Tuscan Archipelago, 32 are recorded for Elba and 18 for Capraia (Gardini, 1976). Among the 10 Sardinian species of Neanuridae (Collembola), 2 are also present on Elba (5 species) whereas 1 species is also found on Capraia (2 species) (Dallai, 1983). Holdhaus (1923, 1924) listed 803 species of Coleoptera for Elba and estimated a total of about 1,500 species for the island, which can be compared to the 2,725 Corsican species. Holdhaus (1923, 1924) found 13 Hydradephaga species on Elba (species n. 1, 7, 12, 13, 19, 25, 29, 31, 33, 36, 44, 50, 51). He included *Graptodytes fractus* and *Agabus binotatus* among the species known from Corsica, Sardinia, Elba and also from the Italian peninsula, and *Agabus aubei* among those occurring in Corsica and Elba but which are missing on continental Italy. Among the Hydradephaga there are no Elban and Apennine endemics.

The comparison of the hydradephagan beetle species of Sardinia, Corsica, Elba, Capraia and Tuscany (fig. 26) was based upon Franciscolo (1979, fig. 2230), Rocchi (1980, 1984), Angelini (1984), Rocchi (1986), Burmeister et al. (1987), Fery (1991, 1992), Rocchi (1991), Angelini (1993), Fery & Nilsson (1993), Dettner (1997), Fery & Brancucci (1997), Vondel (1997), Rocchi (2000, 2001), Millán & Ribera (2001), Nardi & Maltzeff (2001) and Pederzani et al. (2004). The number of species from Elba has increased since the publi-



cation by Franciscolo (1979); a large number of these newly recorded species are also known from facing mainland Tuscany. The similarity of the Elban and Capraian species inventories with that of adjacent Tuscany is remarkable, and may be due to their relative closeness. In contrast, the similarity of the Elban species inventory to those of Corsica and especially Sardinia is distinctly lower.

The four Elban species which are not recorded from mainland Tuscany are: *Bidessus saucius*, *Stictotarsus procerus*, *Agabus aubei* and *Noterus crassicornis*. Capraia's five additional species not recorded from Elba are: *Hyphydrus aubei*, *Graptodytes ignotus*, *Laccophilus minutus*, *Agabus nebulosus* and *Hygrobia hermanni*. Capraia has slightly more species in common with Corsica or Sardinia than with Elba. In addition, it is remarkable that the number of species in common between Sardinia and Corsica is high.

The zoogeographical comparison of Elban Trichoptera (Moretti & Cianficconi, 1981), which have aquatic larvae and terrestrial adults, with Elban Hydradeephaga is illustrated in figs 26-27. The number of species of both taxa on the island is lower than those from Tuscan mainland. Moreover, the number species shared by Elba and the mainland is also considerably high in the Trichoptera. On the other hand, in the Trichoptera, as opposed to the Hydradeephaga there is only a low similarity between Elba and Corsica+Sardinia and between Corsica+Sardinia and Tuscan mainland (fig. 27). Moreover, as opposed to the Hydradeephaga, the total number of Trichoptera species on either Elba island or Sardinia and the number species in common between Corsica and Sardinia is considerably low. The degree of endemism is high in the Trichoptera of Elba, since there are one endemic species and two subspecies: *Beraea ilvae* Moretti, 1981 (Beraeidae), *Rhyacophila italica ilvana* Moretti, 1981 (Rhyacophilidae) and *Wormaldia variegata denisi* Moretti, 1981 (Philopotamidae) (Moretti et al., 1981). It is noteworthy that these Elban endemic Trichoptera are nearly exclusively found in the western part of the island: 17 localities on western Elba against one on eastern Elba (Moretti et al., 1981).

If the numbers of hydradeephagan species from Corsica, Sardinia, the islands of the Tuscan Archipelago and mainland Tuscany are compared (fig. 28) with the areas of these islands (km<sup>2</sup>), the result is the well-known correlation between number of species and surface area. The current number of species on Elba (51) better suits this picture than the previous lower species' numbers of 25 and 35 provided by Franciscolo (1979) and Rocchi (1980), respectively.

Species' number of a taxonomic group per island is determined by immigration and extinction rates. These values do not only depend on the surface area of an island, but also on the type of island, the taxon in question, the distance of the island from the continent and the number of habitats per island. Although the number of species of Elban Dytiscidae corresponds to the curve in fig. 28, this number seems considerably high when compared with other Mediterranean islands (tab. 1). Wewalka (1975) suggests that the low values of Crete and Cyprus are partially due to their isolated geographic position and to low activity of collectors, whereas the high values of the Ionic Islands is due to the presence of central European species and the high activity of collectors. The species' deficiency in Crete and especially Cyprus is also evident in other insect groups such as Trichoptera or Hymenoptera Apoidea (Wewalka, 1975). Keeping this in mind and considering that the recorded number of Elban Hydradeephaga will certainly increase, these high values for El-



ba may be due to the low distance of the island from the mainland, the presence of both Mediterranean and central European species and the presence of a high number of different habitat types in a confined area.

Tab. 1. Number of species of Dytiscidae and surface areas of some Mediterranean Islands.

Island	km <sup>2</sup>	n. of species	Source
Sicily	25,426	81	Angelini, 1984, 1993
Sardinia	23,813	79	see text
Corsica	8,680	62	Rocchi, 1986
Cyprus	9,251	32	Miller et al., 1997; Nilsson, 2003
Crete	8,261	36	Wewalka, 1975
Ionic islands	2,307	49	Wewalka, 1975
Menorca	683	26	Pons, 1987
Malta	316	14	Rocchi & Schembri, 1992
Elba	223.52	42	present work

CONSERVATION OF ELBAN WATER BEETLES

In the Mediterranean, insect conservation can be achieved by two strategies. Direct measures support a single threatened species, whereas indirect measures conserve a biotope where the species lives (Balletto & Casale, 1991). When both methods are used for protecting aquatic beetles, it should be possible to protect rare amphibians (an example for Elba is *Hyla sarda*) or Odonata at the same time.

On Elba, direct conservation measures should focus on the extremely rare Corso-Elban endemic *Agabus* (“*Metronectes*”) *aubei* and the rare *Stictotarsus procerus*. It is remarkable that the larvae and, later, the adults of the former species, which was supposed to be locally extinct, were found 42 years after its last record. The fact that some larvae were collected demonstrates that the species is reproducing at least in the Seccheto area, which should be protected. However, the exact current distribution and the phenology of both adults and larvae of this species should be investigated first, especially on the western part of the island. The steep wet rocks where larvae and adults live within wet mats of roots should be protected. In addition, an inventory of *Stictotarsus procerus* in the mountain brooks of western Elba should be carried out and the species should be legally protected and included in the Red List of Tuscan Insects. Moreover, the most natural and intact brooks should certainly be surveyed and protected. It is very important to protect the mountain aquatic habitats of Elba (springs, wells, brooks and steep wet rocks), because a considerable fraction of typical Tyrrhenian species is found there. The principle threat to these environments is an increase in human exploitation of the water resources (e.g.: Uviale dei Patresi, loc. 1; Fosso di Acquaviva, loc. 34 and 57) and the construction of trails (e.g. for travellers, mountain-bikers). It is recommended that only a moderate amount of roads and trails be constructed.

The exploitation of water resources on Elba is mainly due to horticulture (e.g. loc. 5). Moreover, wells are captured to exploit drinking water of good quality (e.g. loc. 34).



Therefore, many Elban springs are not accessible to most water beetles. A great conservation problem, especially for *Agabus aubei* and *Stictotarsus procerus*, is the fact that water is being captured by plastic water pipes in often inaccessible mountain places, which causes aquatic habitats (wells, running waters) at lower altitudes to dry out, especially during the summer. In addition, the little remaining water quickly overheats and shows low oxygen levels. In this way the rare species, which are crenophilous animals, are unable to emigrate and are therefore increasingly replaced by ubiquitous species.

Apart from direct measures, indirect measures aimed at preserving the wet high altitude biotopes where both threatened and localized species (loc. 49) live are certainly necessary. The same is true for the coastal wetlands, such as Schiopparello (loc. 25), Campo (loc. 15-19) and Mola (loc. 26-31 and 59). These areas rank among the Mediterranean environments most directly threatened of destruction. Reasons for this are building activities (e.g. hotels at Campo, water pipeline at Mola), land drainage for agricultural use and transformation of wetlands into rice fields. Since most of the water beetle species recorded from Elba live in these wetlands (especially Campo and Mola), it would seem important to create natural reserves even in very small areas, where water pollution should be prevented. Another possibility would be to expand the maximal protection zone of the Tuscan Archipelago National Park in order to include the Mola plain. In this way the protection of the most valuable Elban wetland might be significantly increased.

#### ACKNOWLEDGEMENTS

Mr F. Angelini (Francavilla Fontana), Mrs B. Dettner (Bayreuth), Dr H. Fery (Berlin), Mrs. E. Helldörfer (Bayreuth), Mr S. Kehl (Bayreuth), Mr G. Nardi (Cisterna di Latina), Mr S. Rocchi (Firenze), PD Dr W. Völkl (Bayreuth) and Mrs M. Winter (Bayreuth-Capoliveri) are highly acknowledged for their help, especially for controlling specimens, preparing drawings and for providing me with valuable information, photos and literature. Moreover, Mrs I. Lusebrink (Bayreuth) and Dr D. Whitmore (Porto Mantovano) are thanked for the linguistic revision of the manuscript.

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## Coleotteri Idroade-fagi del Parco Nazionale d'Odzala (Repubblica del Congo) (Coleoptera Haliplidae, Dytiscidae, Noteridae)

**Riassunto** - Questo lavoro è dedicato ai Coleotteri Idroade-fagi raccolti in otto località del Parco Nazionale d'Odzala (Repubblica del Congo); complessivamente sono elencate 73 specie (1 Haliplidae, 65 Dytiscidae e 7 Noteridae). Gli autori descrivono due nuove specie: *Copelatus poun-gai* **n. sp.** (gruppo *erichsonii*, sottogruppo *atrosulcatus*), vicina a *C. andreinii* Régimbart, 1905, *C. compertus* Guignot, 1956 e *C. occultus* Bilardo & Rocchi, 1995 distinguibile per la forma del pene; *Copelatus mbokoensis* **n. sp.** (gruppo *erichsonii*, sottogruppo *vigintistriatus*), vicina a *C. ambiguus* Bertrand & Legros, 1975 ed a *C. singularis* Bilardo & Rocchi, 1995 distinguibile per la forma del pene. Venti specie di Dytiscidi sono segnalate per la prima volta per il territorio congolese (Repubblica del Congo e Repubblica Democratica del Congo). Sono infine fornite osservazioni su alcune delle specie raccolte.

**Abstract** - *Hydrade-phaga* from Odzala National Park (Republic of Congo) (Coleoptera Haliplidae, Dytiscidae, Noteridae).

This work concerns the Coleoptera Hydrade-phaga collected in eight localities of Odzala Natural Park (Republic of Congo); altogether 73 species are listed (1 Haliplidae, 65 Dytiscidae and 7 Noteridae). The authors describe two new species: *Copelatus poun-gai* **n. sp.** (group *erichsonii*, subgroup *atrosulcatus*), related to *C. andreinii* Régimbart, 1905, *C. compertus* Guignot, 1956 and *C. occultus* Bilardo & Rocchi, 1995 distinguishable by penis; *Copelatus mbokoensis* **n. sp.** (group *erichsonii*, subgroup *vigintistriatus*), related to *C. ambiguus* Bertrand & Legros, 1975 and *C. singularis* Bilardo & Rocchi, 1995 distinguishable by penis. Twenty species of Dytiscidae are firstly recorded for the Congolese territory (Republic of Congo and Democratic Republic of Congo). Finally observations on some of the collected species are given.

**Key words:** Haliplidae, Dytiscidae, Noteridae, *Copelatus*, faunistic list, new species, Republic of Congo.

### INTRODUZIONE

Il Parco Nazionale d'Odzala (fig. 1) si trova poco sopra l'Equatore, nella zona nord-occidentale dell'attuale Repubblica del Congo, presso il confine con il Gabon ed è compreso entro le seguenti coordinate geografiche: latitudine 0°23' - 1°10' Nord, longitudine 14°39' - 15°11' Est. Il suo nucleo originario venne istituito il 13 aprile 1935; successivamente è stato ampliato fino a raggiungere l'odierna estensione di circa 2.850 chilometri quadrati.

Il Parco è gestito da ECOFAC, programma di conservazione e utilizzazione razionale degli ecosistemi forestali in Africa Centrale, frutto della cooperazione tra l'Unione Europea ed i sei Paesi della sottoregione: Cameroun, Guinea Equatoriale, Repubblica Centrafricana, Gabon, Repubblica del Congo e Repubblica Democratica del Congo.

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\* XXXVII nota sui Coleotteri Idroade-fagi.



Nel Parco si accede per via di terra attraverso il Gabon, passando da Mékambo, proseguendo fino al confine di Ekata (ultimo villaggio gabonese) ed entrando in territorio congolese ad Alloba. L'ingresso al Parco Nazionale d'Odzala avviene superando il villaggio di Mbomo e percorrendo la pista che porta al campo tendato di Mboko.

La caratteristica peculiare di quest'area è dovuta alla presenza di savane e di foreste (con tutta una serie di zone di transizione) e soprattutto alla presenza di particolari ambienti chiamati saline (o anche bai), costituiti da formazioni erbose aperte ed umide, relativamente poco estese, contornate da foresta, con suolo molto ricco di sali minerali.

Le suddette saline o bai (che si incontrano principalmente risalendo il fiume Mambili) sono infatti formate da piccoli corsi d'acqua che, uscendo dalla foresta, percorrono la formazione erbosa allargando il loro letto per poi rientrare in foresta. Contrariamente alle savane, soggette a incendi periodici in coincidenza dell'inaridimento durante la stagione secca, le saline, essendo riparate e costantemente umide, non vengono abitualmente percorse dal fuoco.

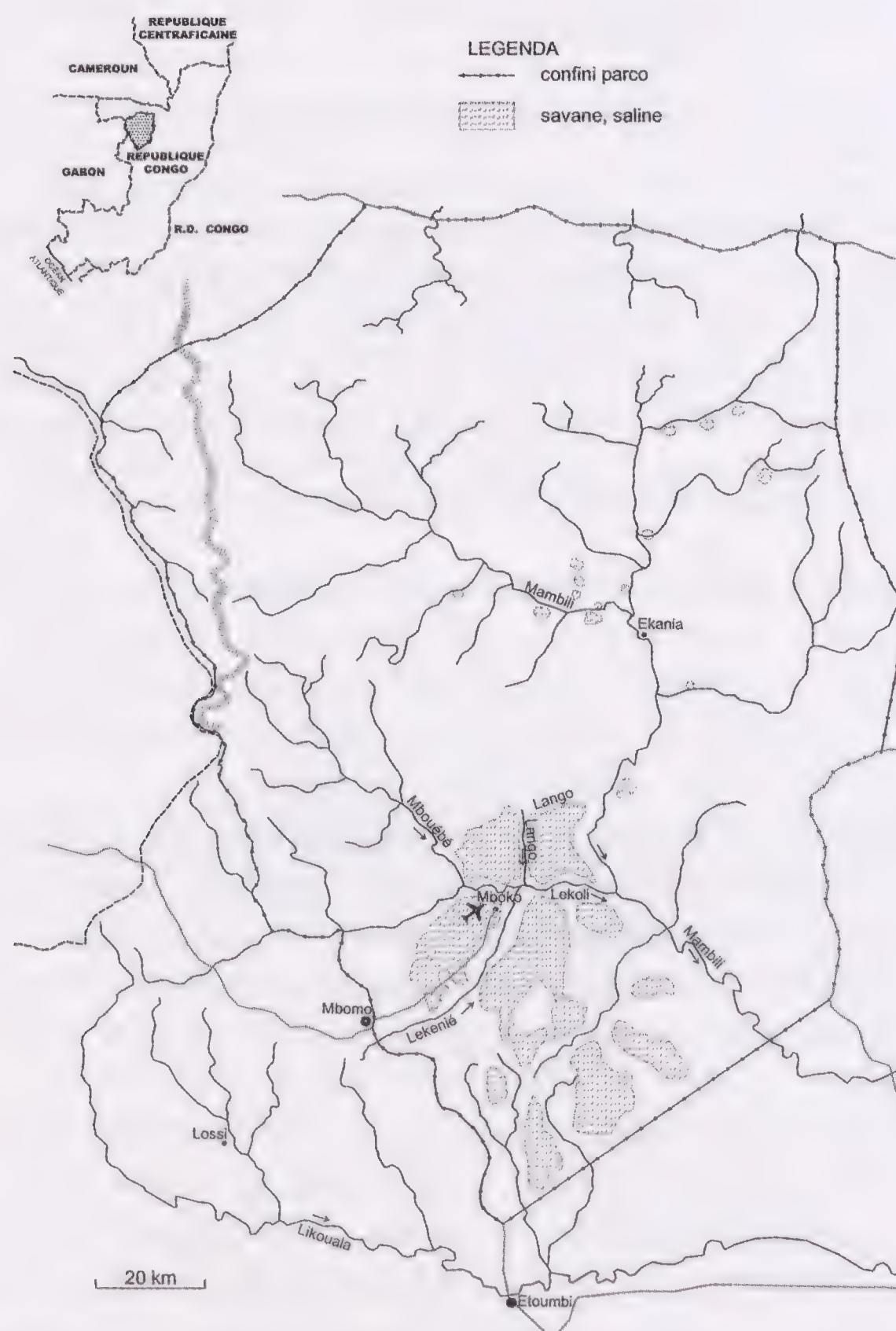


Fig. 1. Carta schematica del Parco Nazionale d'Odzala.



Per la presenza di sali minerali e della rigogliosa vegetazione erbacea sono inoltre frequentate da molti grandi animali ed in particolare dagli elefanti, che scavano delle buche dalle quali aspirano l'acqua. Nelle zone settentrionali del Parco vi sono formazioni analoghe, in realtà più propriamente simili a radure paludose, frequentate fra l'altro dai gorilla che si nutrono della vegetazione acquatica erbacea.

Nella zona meridionale, attorno a Mboko, vi sono savane erbose umide ubicate nella parte più bassa e savane arbustive in quella più alta, contornata dalla foresta galleria lungo il fiume Lékénié.

L'integrità e la varietà degli ambienti naturali è accompagnata da una notevole ricchezza biologica, essendovi rappresentata gran parte della fauna e della flora proprie dell'Africa occidentale; per ogni approfondimento si rimanda a Christy (1999) ed alle varie fonti bibliografiche citate in detta pubblicazione.

Infine, sotto l'aspetto strettamente entomologico, la zona risulta già visitata almeno una volta per la raccolta di Coleotteri Idroadepti e cioè nel 1963 in occasione della missione in Congo di A. Villiers e A. Descarpentries (Bertrand & Legros, 1975). In tale lavoro, per la località d'Odzala, vengono segnalate 14 specie di Ditiscidi, 8 di Noteridi e 3 di Girinidi; si tratta di specie in massima parte non reperite nelle raccolte oggetto del presente contributo; soltanto quattro specie risultano infatti presenti anche nel nostro elenco e precisamente il Ditiscide *Methles cribratellus* (Fairmaire, 1880) e i Noteridi *Neohydrocoptus africanus* (Gschwendtner, 1930), *Synchortus simplex* Sharp, 1882 e *Hydrocanthus* (*Sternocanthus*) *micans* Wehncke, 1883.

#### LOCALITÀ DI RACCOLTA

Le ricerche sono state condotte da uno degli autori (Bilardo) nel periodo 20-28 agosto 2002; per la raccolta del materiale è stato usato un retino circolare da acqua del diametro di 30 cm; nelle righe che seguono sono fornite alcune brevi informazioni sulle otto località visitate.

- 1) Mbouébé - Il biotopo si trova vicino a Mboko ed è costituito da una savana situata sulla riva sinistra del fiume Lékoli (fig. 2). Si presenta come una pianura paludosa con vegetazione di Graminacee e Ciperacee ed altre piante erbacee; vi sono tuttavia anche vaste zone prive di vegetazione. Le raccolte sono state effettuate nella foresta riparia che si attraversa provenendo dal fiume Mbouébé ed in pozzette situate nella savana vera e propria. Tutti i *Copelatus* Erichson, 1832 raccolti provengono dalla foresta riparia, gli altri Ditiscidi e la maggior parte dei Noteridi dalla savana. Tempo di ricerca 1 ora circa.
- 2) Lango - Anche questo biotopo è costituito da una savana che si trova vicino a Mboko ed è ugualmente situata sulla riva sinistra del fiume Lékoli, a Est di Mbouébé (fig. 3). La zona è coperta da una vegetazione di Graminacee e Ciperacee ed altre piante acquatiche. Le ricerche hanno riguardato soprattutto le buche (per lo più erbose) ai bordi della savana e le pozze lungo il ruscello allo sbocco nella savana, dove sono stati raccolti gli unici tre esemplari di *Copelatus* Erichson, 1832. Tempo di ricerca 4 ore circa.
- 3) Mboko, Marigot Poulu - L'ambiente è costituito da un ruscello che scorre, su fondo sabbioso-ghiaioso, nella foresta sulla riva sinistra del fiume Lékoli. Le ricerche sono state effettuate ispezionando le anse lungo le rive e soprattutto le buche formate dalle impronte degli elefanti. Tempo di ricerca 2 ore circa.





Fig. 2. Savana di Mboué-bé (foto A. Bilardo).



Fig. 3. Savana di Lango (foto A. Bilardo).



Fig. 4. Fiume Mambili (foto A. Bilardo).



Fig. 5. Salina di Ambéré  
(foto A. Bilardo).



Fig. 6. Fiume Lokoué (fo-  
to A. Bilardo).



Fig. 7. Salina di Ibonzi  
(foto A. Bilardo).





- 4) Ekania, MOUNGALI - Da Mboko, discendendo il fiume Lékoli fino alla confluenza con il fiume Mambili (fig. 4) e risalendo quest'ultimo per circa 6 ore e mezzo, si raggiunge il campo tendato di Ekania, situato sulla riva sinistra del fiume. Sulla riva destra, poco più a monte, si trova la salina di MOUNGALI, consistente in una vasta prateria a Ciperacee con fondo melmoso e contornata dalla foresta. Le ricerche sono state condotte sia nella zona centrale della prateria (soprattutto in piccole pozze erbose con vegetazione palustre, formate dal passaggio di grandi mammiferi, per lo più bufali), sia nella zona terminale dove il corso d'acqua esce dalla prateria ed entra nella foresta. Tempo di ricerca 4 ore circa.
- 5) Ekania, AMBÉRÉ - Risalendo per circa un'ora il fiume Koukoua, affluente di sinistra del fiume Mambili, dopo aver attraversato una stretta fascia di foresta riparia, si raggiunge la riva destra dove è situata la salina di AMBÉRÉ (fig. 5). Essa è formata da una grande radura paludosa, ricoperta da una vegetazione erbacea di Ciperacee e con piccoli alberi a cespuglio; al centro è percorsa da un ruscello a fondo sabbioso. Le ricerche sono state condotte in pozze laterali (con ricca vegetazione palustre) prodotte dal calpestio di grandi mammiferi. Tempo di ricerca 1 ora circa.
- 6) Ekania, KOUKOUA - Il fiume Koukoua, a causa della stagione, risulta in regime di magra e lungo la corrente principale presenta pozze ed anse separate o collegate alla corrente stessa; il fondo appare finemente sabbioso e ricoperto da detriti vegetali. L'ombra degli alberi copre le rive e buona parte della corrente principale. Le ricerche sono state effettuate sulla riva destra fra le radici pensili di un grande albero ed hanno riguardato un'unica pozza collegata alla corrente principale. Tempo di ricerca mezz'ora circa.
- 7) Ekania - L'ambiente esplorato è situato in foresta, a circa trenta minuti di marcia a Nord del campo di Ekania. Trattasi di una depressione corrispondente al letto, non ben delimitato, di un ruscello dove l'acqua impregna il suolo costituito da foglie e altri detriti vegetali. Le raccolte sono state effettuate nelle pozze circolari lasciate dalle impronte degli elefanti. Tempo di ricerca 2 ore circa.
- 8) Lokoué - Il fiume Lokoué (fig. 6) è un affluente di sinistra del fiume Mambili; il campo base si raggiunge in circa 2 ore di piroga da Ekania e si prosegue per un'ora e mezzo circa di marcia, lungo una pista in foresta, fino ad arrivare alla salina di Ibonzi (fig. 7). La suddetta pista interseca quattro ruscelli ("marigots"), lungo i quali sono state effettuate le ricerche. Il primo ruscello è molto piccolo e si trova a circa mezz'ora di marcia dal campo; il fondo è sabbioso; tempo di ricerca mezz'ora circa. Il secondo è il più grande e si trova a circa un'ora di marcia dal campo; il fondo è sabbioso; tempo di ricerca 4 ore circa. Il terzo è molto piccolo e si trova a circa un quarto d'ora dal precedente; in esso non sono state effettuate ricerche. Il quarto è situato nella foresta immediatamente prima della salina di Ibonzi; scorre su fondo roccioso e sabbioso; tempo di ricerca tre quarti d'ora circa. Nella salina non è stato possibile svolgere ricerche perché erano in corso osservazioni sugli animali che la frequentano.

#### ELENCO DELLE SPECIE RACCOLTE

Tutte le specie reperite nelle suindicate località sono state riepilogate nella tab. 1; in corrispondenza di ciascuna di esse sono state inserite delle crocette per rappresentare il numero di esemplari raccolti e precisamente: + uno o due, ++ fino a dieci, +++ oltre



dieci esemplari; nella tabella le otto località sono contraddistinte con il relativo numero di riferimento riportato nel testo.

Complessivamente sono elencate 73 specie di Coleotteri Idroadeefagi e precisamente 1 Haliplidae, 65 Dytiscidae e 7 Noteridae. Alcuni taxa, di cui sono stati raccolti soltanto esemplari di sesso femminile, sono rimasti indeterminati e non figurano in tabella; essi appartengono ai generi *Hyphydrus* Illiger, 1802, *Hydroglyphus* Motschulsky, 1853, *Uvarus* Guignot, 1939, *Clypeodytes* Régimbart, 1894, *Laccophilus* Leach, 1815 e *Neptosternus* Sharp, 1882. Venti specie di Ditiscidi, peraltro già note di uno o più paesi dell’Africa occidentale, non risultavano ancora espressamente segnalate per il territorio congolese, vale a dire quello costituito dalle attuali Repubblica del Congo e Repubblica Democratica del Congo (cfr. Bilardo & Rocchi, 1986, 1990, 1995, 1999 e 2002, Biström, 1979, 1983, 1984, 1988a e 1988b, Pederzani, 1983); nella tabella tali specie sono quelle precedute da un asterisco (\*).

Il materiale è preparato a secco ed è conservato nelle collezioni degli autori.

Tabella 1. Elenco delle specie raccolte nelle varie località.

Famiglia e specie	Località							
	1	2	3	4	5	6	7	8
<b>Haliplidae</b>								
<i>Peltodytes congoensis</i> Zimmermann, 1924					+			
<b>Dytiscidae</b>								
<i>Methles cribratellus</i> (Fairmaire, 1880)							+	
* <i>Derovatellus</i> ( <i>Derovatellus</i> ) <i>dimorphus</i> Guignot, 1936			+					+++
<i>Hyphydrus agnitus</i> Guignot, 1952							+++	
* <i>Hyphydrus bistroemi</i> Bilardo & Rocchi, 1986							+	
* <i>Hyphydrus quadrisulcatus</i> Bilardo & Rocchi, 1986								++
* <i>Hyphydrus lanzai</i> Bilardo & Rocchi, 1986								+++
* <i>Hyphydrus vassalloi</i> Bilardo & Rocchi, 1990								+
* <i>Hyphydrus imitator</i> Biström, 1984				+++	+			
<i>Hydrovatus acuminatus</i> Motschulsky, 1859				+				
<i>Hydrovatus bomansi</i> Guignot, 1955		+		++	++			
<i>Hydrovatus parvulus</i> Régimbart, 1899				++				
<i>Hydrovatus scholaeus</i> Guignot, 1958		+						
<i>Hydrovatus</i> “complex” <i>deserticola</i> sensu Biström, 1997		++		+++	+			
<i>Hydrovatus omentatus</i> Guignot, 1950				+				
<i>Uvarus flavicans</i> (Régimbart, 1895)							+	
<i>Uvarus baoulicus</i> (Guignot, 1939)	++							
<i>Hydroglyphus dakarensis</i> (Régimbart, 1895)	+++	+++		+++	+++			
<i>Hydroglyphus rocchii</i> Biström, 1986	+++	+++		+++	+++			
<i>Hydroglyphus lenzi</i> (Gschwendtner, 1930)	+							
* <i>Liodessus legrosi</i> Biström, 1988							+++	
<i>Bidessus complicatus</i> Sharp, 1904		+++		+++	++			
<i>Platydytes coarctaticollis</i> (Régimbart, 1894)						+		
<i>Leiodytes hieroglyphicus</i> (Régimbart, 1894)				+			+	
* <i>Africodytes rubromaculatus</i> Biström, 1988						+++		
* <i>Yola cuspis</i> Bilardo & Pederzani, 1978		+++		+++	+++	+		
<i>Laccophilus bilardo</i> i Pederzani & Rocchi, 1982		+						
* <i>Laccophilus concettae</i> Pederzani, 1983							+	



Famiglia e specie	Località							
	1	2	3	4	5	6	7	8
<i>Laccophilus remex</i> Guignot, 1952		+		++	++			
<i>Laccophilus</i> sp. (gruppo <i>vermiculosus</i> )	+	+++		+++	+++			
<i>Laccophilus congener</i> Omer-Cooper, 1957		+		++				
<i>Laccophilus desintegratus</i> Régimbart, 1895								+
* <i>Philaccolus ondoi</i> Bilardo & Rocchi, 1990						+		
<i>Copelatus supplementaris</i> Régimbart, 1895	+		+					+++
<i>Copelatus anthracinus</i> Régimbart, 1895								++
<i>Copelatus mocquerysi</i> Régimbart, 1895								++
<i>Copelatus vigintisulcatus</i> Régimbart, 1895	+		+++					+++
<i>Copelatus pantosi</i> Guignot, 1958	+		++			++		++
* <i>Copelatus aemulus</i> Bilardo & Rocchi, 1995		+	+++					++
* <i>Copelatus nzei</i> Bilardo & Rocchi, 1999			+					+
<i>Copelatus atosulcatus</i> Régimbart, 1906								+++
<i>Copelatus onorei</i> Pederzani & Rocchi, 1982			+++					++
<i>Copelatus poungai</i> n. sp.			+					
* <i>Copelatus inopinatus</i> Bilardo & Rocchi, 1995			++					
<i>Copelatus camerunensis</i> Guignot, 1941								+++
<i>Copelatus mbokoensis</i> n. sp.	+							
* <i>Copelatus punctatus</i> Bilardo & Rocchi, 1995			+					
* <i>Copelatus fasciatus</i> Bilardo & Rocchi, 1995			+					
<i>Copelatus flavidus</i> Régimbart, 1895								+++
<i>Copelatus burgeoni</i> Gschwendtner, 1930	+	+	+					
* <i>Copelatus pederzanii</i> Bilardo & Rocchi, 1995								+++
* <i>Copelatus latifasciatus</i> Bilardo & Rocchi, 1999	+		+++				+++	+
* <i>Copelatus hardenbergi</i> J. Balfour-Browne, 1950							+	
* <i>Copelatus assimilis incristatus</i> Bilardo & Rocchi, 2002			+++					+++
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>laceratus</i> Régimbart, 1895							+	++
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>quadriguttatus</i> Régimbart, 1895							+	++
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>scapularis</i> Guignot, 1952								+
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>leander</i> (Rossi, 1790)	++	++		++	++			
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>pescheti</i> Gschwendtner, 1930	+							
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>arcuatus</i> Régimbart, 1895								+
<i>Hydaticus</i> ( <i>Guignotites</i> ) <i>matruelis</i> Clark, 1864			+				+	
<i>Rhantaticus congestus</i> (Klug, 1833)							+	
<i>Aethionectes bokumanus</i> Guignot, 1956			+				++	
<i>Regimbartina pruinosa</i> (Régimbart, 1895)							+	
<i>Cybister</i> ( <i>Melanectes</i> ) <i>vulneratus</i> Klug, 1834				++				
<i>Cybister</i> ( <i>Melanectes</i> ) <i>marginicollis</i> Boheman, 1848		+						
<b>Noteridae</b>								
<i>Neohydrocoptus africanus</i> (Gschwendtner, 1930)		+						
<i>Neohydrocoptus angolensis</i> (Peschet, 1925)				++			++	
<i>Neohydrocoptus uellensis</i> (Guignot, 1953)		+++		++				
<i>Synchortus simplex</i> Sharp, 1882				++				
<i>Canthydrus</i> ( <i>Canthydrus</i> ) <i>bisignatus</i> Wehncke, 1883		+						
<i>Hydrocanthus</i> ( <i>Sternocanthus</i> ) <i>micans</i> Wehncke, 1883		+						
<i>Hydrocanthus</i> ( <i>Sternocanthus</i> ) <i>klarae</i> Gschwendtner, 1930		++		++				



## DESCRIZIONE DELLE NUOVE SPECIE

Le descrizioni che seguono sono volutamente concise e limitate soltanto a pochi aspetti morfologici esterni, in quanto il carattere fondamentale di distinzione è rappresentato dalla conformazione del pene.

***Copelatus pougai* n. sp. (figg. 8-9)**

DIAGNOSI. Un *Copelatus* appartenente al gruppo *erichsonii*, sottogruppo *atrosulcatus* (sensu Guignot, 1961), vicino al complesso di taxa con pronoto non striolato ed elitre a base concolore (*C. andreinii* Régimbart, 1905, *C. compertus* Guignot, 1956 ed *C. occultus* Bilardo & Rocchi, 1995), nell'ambito dei quali (cfr. Nilsson et al., 1996) si può riconoscere soltanto attraverso l'esame della conformazione del pene.

LOCALITÀ TIPICA. Repubblica del Congo, Parco Nazionale d'Odzala, Mboko, marigot Poulu.

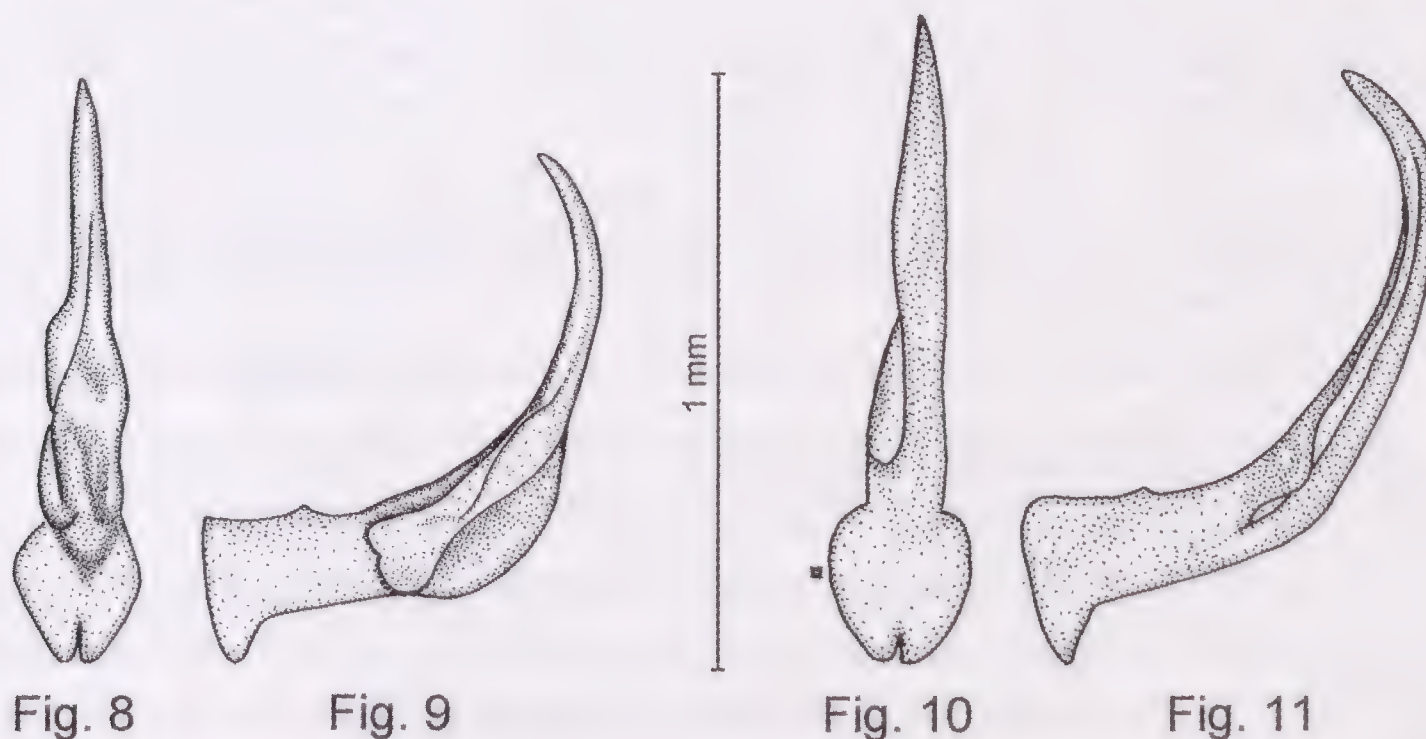
SERIE TIPICA. Holotypus maschio, Repubblica del Congo, Parco Nazionale d'Odzala, Mboko, marigot Poulu, 22.08.2002, leg. A. Bilardo (in collezione A. Bilardo).

DESCRIZIONE. Lunghezza 4,75 mm, larghezza 2,45 mm. Capo nero con margine anteriore rossastro; antenne, palpi e zampe ferruginee. Pronoto nero con angoli anteriori rossastri, senza striole e con una serie di punti impressi sui lati. Elitre nere con dieci strie dorsali ed una submarginale; risultano leggermente scostate dalla base le prime due strie ed anche la quinta e la nona. Parte inferiore bruno ferruginea scura. Maschio: pene (figg. 8-9).

DERIVATIO NOMINIS. Specie dedicata a Gaston Ponga, guida del villaggio di Mbomo.

***Copelatus mbokoensis* n. sp. (figg. 10-11)**

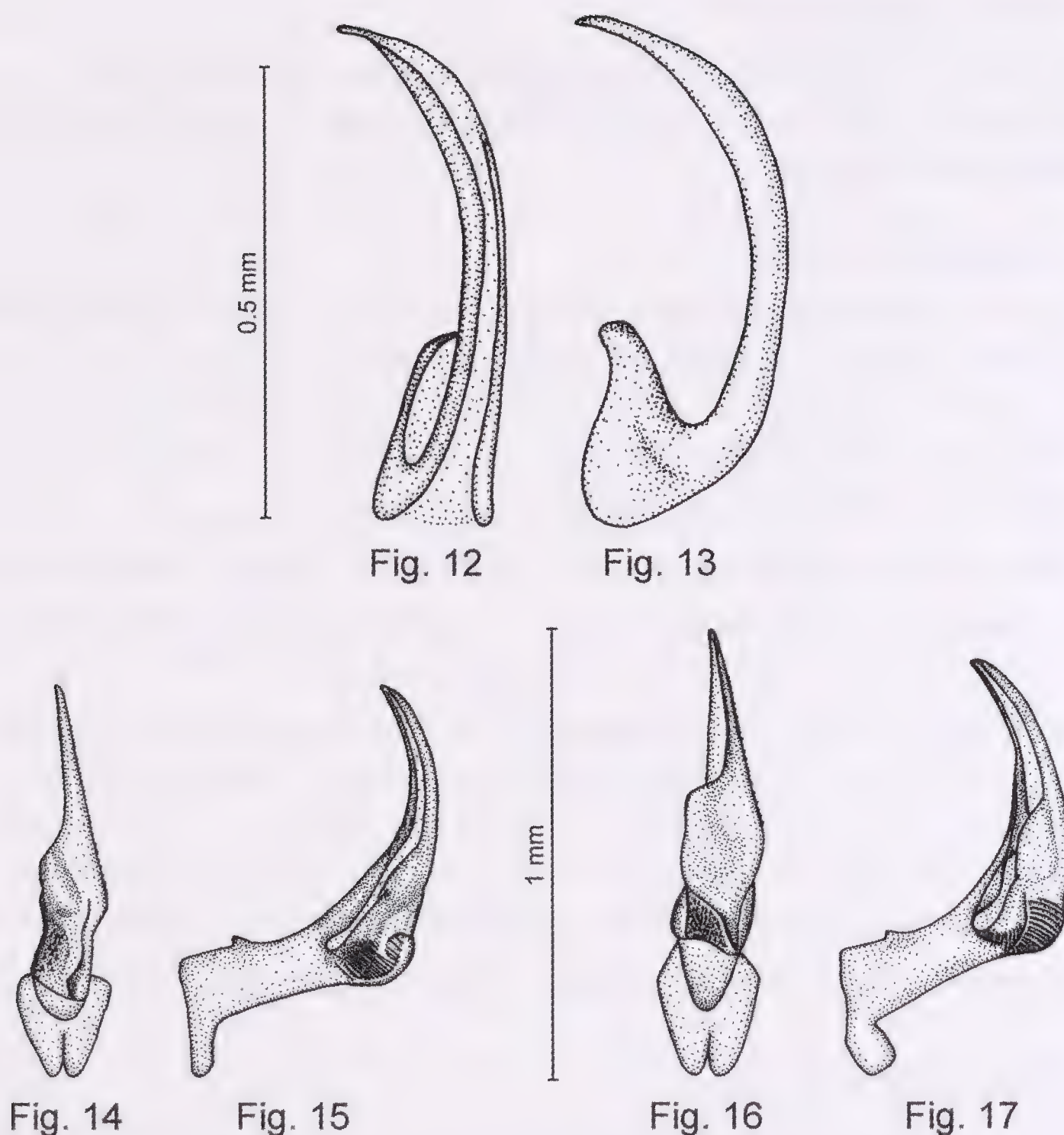
DIAGNOSI. Un *Copelatus* appartenente al gruppo *erichsonii*, sottogruppo *vigintistriatus* (sensu Guignot, 1961), vicino al complesso di taxa gravitanti attorno a *C. parumstriatus* Gschwendtner, 1934; per l'aspetto esterno (dimensioni e colorazione nera delle elitre) as-



Figg. 8-9. *Copelatus pougai* n. sp., holotypus ♂: 8 - pene in visione dorsale; 9 - idem, in visione laterale (disegno A. Bilardo).

Figg. 10-11. *Copelatus mbokoensis* n. sp., holotypus ♂: 10 - pene in visione dorsale; 11 - idem, in visione laterale (disegno A. Bilardo).





Figg. 12-13. *Africodytes rubromaculatus* Biström (♂; Ekania, Koukoua): 12 - pene in visione dorsale; 13 - idem, in visione laterale (disegno A. Bilardo).

Figg. 14-15. *Copelatus pederzanii* Bilardo & Rocchi (♂; Repubblica del Congo, Parco Nazionale d'Odzala, Lokoué): 14 - pene in visione dorsale; 15 - idem in visione laterale (disegno A. Bilardo).

Figg. 16-17. *Copelatus apuzzoi* Bilardo & Rocchi (♂; Gabon, Makokou, Fiume Ivindo, rapides): 16 - pene in visione dorsale; 17 - idem in visione laterale (disegno A. Bilardo).

somiglia ad *C. ambiguus* Bertrand & Legros, 1975 ed a *C. singularis* Bilardo & Rocchi, 1995, ma la conformazione del pene risulta chiaramente differente (cfr. Nilsson et al., 1996).

LOCALITÀ TIPICA. Repubblica del Congo, Parco Nazionale d'Odzala, Mboko, Mbouébé.

SERIE TIPICA. Holotypus maschio, Repubblica del Congo, Parco Nazionale d'Odzala, Mboko, Mbouébé, 20.08.2002, leg. A. Bilardo (in collezione A. Bilardo).

DESCRIZIONE. Lunghezza 5,40 mm, larghezza 2,70 mm. Capo nero, antenne, palpi e zampe ferruginee. Pronoto nero con lati ferruginei, non striolato; soltanto sui lati sono presenti alcuni punti. Eltre nere con dieci strie dorsali ed una submarginale; la prima stria è evidentemente accorciata e frammentata alla base (per circa un settimo della sua lunghezza), mentre la quinta e la nona risultano leggermente scostate dalla base. Parte inferiore bruno ferruginea. Maschio: pene (figg. 10-11).

DERIVATIO NOMINIS. Dal nome della località di raccolta.



## OSSERVAZIONI SU ALCUNE SPECIE

*Derovatellus (Derovatellus) dimorphus* Guignot, 1936

La determinazione di questa specie, considerate le difficoltà per separarla dall'affine *D. decellei* Biström, 1979 (cfr. Biström, 1979), è stata fatta controllare da O. Biström (Helsinki); le lievi differenze fra i due taxa, oltre tutto, non sempre risultano costanti ed il collega (comunicazione in litteris) non esclude la possibilità che *D. decellei*, in definitiva, costituisca una semplice variazione di *D. dimorphus*.

*Africodytes rubromaculatus* Biström, 1988

Il pene (figg. 12-13) degli esemplari raccolti, soprattutto in visione dorsale, presenta un profilo chiaramente sinuoso, mentre nella figura riportata in Biström (1988a) sembra avere un andamento pressoché rettilineo. Alcuni esemplari, come quello riportato in figura, presentano l'apice deviato a destra, altri esemplari presentano l'apice deviato a sinistra. Tuttavia, per dirimere qualsiasi dubbio, anche questa determinazione è stata controllata e confermata da Biström.

*Laccophilus* sp. (gruppo *vermiculosus*)

Gli esemplari raccolti appartengono al gruppo *vermiculosus* (sensu Guignot, 1959) e gravitano intorno al difficile complesso *adpersus-modestus*; praticamente sono indeterminabili fino a quando non si potrà disporre di una revisione basata sull'esame dei tipi; abbiamo perciò ritenuto opportuno non indicare alcun nome specifico, che sarebbe risultato solo approssimativo.

*Copelatus vigintisulcatus* Régimbart, 1895

Nel materiale raccolto nel Parco Nazionale d'Odzala, ma anche in alcune località del Gabon, è già stata segnalata (Bilardo & Rocchi, 2004) la convivenza nello stesso biotopo di esemplari con differente conformazione dei due speroni metatibiali: in alcuni sono chiaramente robusti (con quello interno leggermente curvato verso l'estremità), in altri sono esili ed entrambi diritti. Riteniamo che ciò possa rientrare nella notevole variabilità riscontrabile in alcuni caratteri di questo taxon, compresa la conformazione del pene.

*Copelatus pantosi* Guignot, 1958

Recentemente (Bilardo & Rocchi, 2004) siamo pervenuti alla conclusione che *C. fallax* Bilardo & Pederzani, 1978 è da considerarsi sinonimo di *C. pantosi*, come rilevato mediante l'esame dell'olotipo di quest'ultima specie.

*Copelatus pederzanii* Bilardo & Rocchi, 1995

Facciamo notare che esternamente questa specie è praticamente indistinguibile da *C. apuzzoi* Bilardo & Rocchi, 1999; ambedue sono inoltre alquanto variabili (colore, impressione ed estensione delle strie, quest'ultime talvolta variamente frammentate) e ciò rende ancora più difficoltosa la loro separazione. La differenza sostanziale risiede comunque



nel pene che in *C. apuzzoi* è più robusto e presenta in visione laterale una caratteristica sporgenza conformata a cresta. Eccezionalmente *C. apuzzoi* può presentare nel profilo dorsale di questa sporgenza un incavo più o meno accentuato, così da assomigliare al pene di *C. pederzanii* in visione laterale. Per questo motivo abbiamo ritenuto opportuno riproporre i disegni del pene dei due seguenti esemplari: *C. pederzanii*, Repubblica del Congo, Parco Nazionale d'Odzala, Lokoué, 28.08.2002, leg. A. Bilardo (figg. 14-15) e *C. apuzzoi*, Gabon, Makokou, Fiume Ivindo, rapides 16 km S-W Loa-Loa, 4.09.1998, leg. A. Bilardo (figg. 16-17).

#### *Copelatus latifasciatus* Bilardo & Rocchi, 1999

Gli esemplari del Parco Nazionale d'Odzala presentano la prima stria elitrale accorciata anteriormente in maniera molto variabile; per tale motivo, come già fatto notare (Bilardo & Rocchi, 2004), abbiamo ritenuto di trasferire questa specie dal sottogruppo (sensu Guignot, 1961) *atrosulcatus* al sottogruppo *vigintistriatus*.

#### RINGRAZIAMENTI

Si ringraziano i funzionari di ECOFAC di Libreville che hanno organizzato la spedizione ed hanno procurato i permessi necessari per raggiungere il Parco Nazionale d'Odzala e per effettuare le ricerche entomologiche; in particolare il Dr. Jean Marc Froment, il Dr. Philippe Quennery ed il Sig. Ladis, nonché il Sig. Gaston Pounga, guida all'interno del Parco medesimo, sempre disponibile e desideroso di apprendere quanto più possibile sugli insetti. Ringraziamo inoltre il Dr. Olof Biström (Helsinki) per il controllo di alcune determinazioni.

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## The Hydradephaga of the Segura basin (SE Spain): twentyfive years studying water beetles (Coleoptera)

**Abstract** - We present the results of 25 years of study of the faunistics, biogeography, ecology and conservation of the Hydradephaga of the Segura river basin. Eighty one species have been recorded from the area, ca. 45% of the total of species found in the Iberian peninsula. Six of them are Iberian endemics, and fourteen are considered to be rare within the basin, although most of these are not rare in an Iberian context.

The phenetic hierarchy of relationships among the western-Palaeartic regions considered shows a clear similarity of the fauna of the Segura basin with that of the Maghreb, which, together with the rest of the Iberian fauna form a well defined group isolated from the rest of the European areas. Within the Iberobaleare region, there is also a clear north-south division, with a secondary classification into western and eastern basins. The Balearic islands seem to be a relatively independent biogeographical unit, although more related with the southern cluster.

The environmental characteristics determining the distribution of the Hydradephagan fauna in the study area, as determined by Correspondence Analysis, are altitude, degree of mineralization of the water, and amount and type of riparian vegetation.

Using a semi-quantitative scoring system to evaluate the vulnerability of the species only *Hydroporus decipiens* had a vulnerability value considered to be high (9), due to its rarity within the basin and to its general restricted distribution, although the incomplete knowledge of its distribution and taxonomy could be a distorting factor. With a similar value (8), *Nebrioporus baeticus* is a typical inhabitant of saline running waters, highly endangered habitat due to the increasing use of irrigation in the surrounding fields.

The stations with the highest conservation interest were mountain streams in the NW of the basin, which are also of high conservation interest for other aquatic Coleoptera (e.g. Hydraenidae). A disadvantage of the index applied (IC, "conservation interest") is the lack of reference to the conservation interest of habitats outside the study area. Thus, the saline or hypersaline streams, which are extremely rare in an European (or even global) context, are not considered of particular relevance due to the poor species richness and local abundance. The use of other criteria for the selection of sites of conservation value, such as complementarity, could overcome this limitation.

**Riassunto** - Gli Idrodefagi del bacino del Segura (Spagna sud-orientale): venticinque anni studiando coleotteri acquatici (Coleoptera).

Gli autori presentano i risultati di 25 anni di studio sulla faunistica, biogeografia, ecologia e conservazione degli Hydradephaga del bacino del fiume Segura. Ottantuno specie sono state segnalate dell'area, pari a circa il 45% delle specie note della Penisola Iberica. Sei di queste specie sono endemiche iberiche e 14 sono considerate rare nel bacino, malgrado la maggior parte di queste non siano rare nel contesto iberico.

La gerarchia fenetica delle relazioni tra le aree ovest-paleartiche considerate mostra una chiara similarità della fauna del bacino del Segura con quella del Maghreb, che, insieme al resto della fauna iberica forma un gruppo ben definito isolato dalle restanti aree europee. All'interno della regione ibero-baleare, c'è anche una chiara divisione nord-sud, con una suddivisione secondaria nei bacini occidentali e orientali. Le Isole Baleari sembrano essere un'unità biogeografica relativamente indipendente, anche se più correlata al gruppo meridionale.

Le caratteristiche ambientali determinanti la distribuzione dell'Idrodefagofauna nell'area di studio, come stabilite con l'analisi della corrispondenza, sono: altitudine, grado di mineralizzazione dell'acqua, quantità e tipo della vegetazione riparia.



Utilizzando un sistema di punteggio semi-quantitativo per valutare la vulnerabilità delle specie, solo per *Hydroporus decipiens* è stato riscontrato un valore di vulnerabilità considerato elevato (9), a causa della sua rarità all'interno del bacino e della sua distribuzione generale ristretta, sebbene l'incompleta conoscenza della sua distribuzione e tassonomia potrebbero essere un fattore distorcente. Un valore simile (8) è stato riscontrato per *Nebrioporus baeticus*, un tipico abitante delle acque correnti saline, un habitat fortemente minacciato dall'aumento dell'uso dell'irrigazione nei campi circostanti.

Le stazioni con il più elevato interesse conservazionistico sono risultate i torrenti montani nel nord-ovest del bacino che sono anche di elevato interesse conservazionistico per altri Coleotteri acquatici (es. Hydraenidae). Un inconveniente dell'indice usato (IC, "interesse conservazionistico") è la mancanza di riferimenti all'interesse conservazionistico degli habitat al di fuori dell'area di studio. Quindi, i corsi d'acqua salini o ipersalini, che sono estremamente rari nel contesto europeo (o anche globale), non sono considerati di particolare rilevanza a causa della bassa ricchezza specifica e dell'abbondanza locale. L'uso di altri criteri per la selezione dei siti di valore conservazionistico, come per esempio la complementarità, potrebbe superare questa limitazione.

**Key words:** Iberian peninsula, Segura basin, Coleoptera, Hydradephaga, Faunistical, Biogeography, Ecology, Conservation.

## INTRODUCTION

Waste water, dams and canalisation, overflow from surrounding irrigation fields, over-exploitation of the groundwater reservoirs, or destruction of the riparian vegetation are only some of the factors that have affected the ecological dynamics of seawater bodies (Dechamps & Naiman, 1989; Velasco & Millán, 1995). A pre-requisite for reducing these impacts to preserve the ecological value of our aquatic ecosystems is to know their biodiversity and the processes that, at an ecological or historical scale, have generated this biodiversity. This is particularly so in the Mediterranean basin, one of the world's hotspots of biodiversity (Myer et al., 2000).

For about 25 years the "Ecología acuática" (Aquatic ecology) team of the University of Murcia has developed a series of research projects with the objective of studying, characterising and preserving the biodiversity of aquatic macroinvertebrates of the Segura river basin, an example of a complex and heterogeneous macro-fluvial ecosystem in the Mediterranean region. Through these studies we have gathered a wealth of information on the composition and origin of the aquatic fauna of the Segura basin, the potential role as bioindicators of some of their components, and the general conservation status of both species and habitats.

Earlier works (e.g. Vidal-Abarca, 1985) were more focused on the analysis of general environmental and human aspects at large temporal and spatial scales, but soon more specific studies on the communities of macroinvertebrates were published: water bugs (Millán et al., 1987, 1988), snails (Gómez, 1988) and more recently stoneflies and mayflies (Ubero et al., 1998). The water beetles were soon one of the preferred groups for study, with multiple taxonomic and faunistic studies appearing through this period (Gil et al., 1990; Delgado et al., 1992; Delgado & Soler, 1997), particularly about the Hydradephaga (Millán & Rocchi, 1991; Millán et al., 1992, 1993, 1996, 1997; Millán & Ribera, 2001; Sánchez-Fernández et al., 2004b). For most Spanish entomologists working with Hydradephaga – including us – the magnificent monograph of Professor Mario E. Franciscolo (1979) was a starting point and a continuous reference. With this paper we would like to



contribute to paid tribute to his memory, with a summary of the most important faunistic, biogeographical, ecological and conservation conclusions obtained from the study of the Hydradeephaga in the Segura river basin throughout this time.

## MATERIALS AND METHODS

**GEOGRAPHICAL SITUATION AND ENVIRONMENTAL CHARACTERISTICS.** The river Segura drains into the Mediterranean sea, and its basin has an estimated area of 18.815 km<sup>2</sup>. The Segura river has its source at an altitude of 1,412 m and a total length of 325 km.

The main characteristic of the climate in the basin is aridity (Vidal-Abarca et al., 1992), with long periods of hydric deficit punctuated by scarce precipitation that can nevertheless be torrential locally. The lithology and geology of the area are very complex, with a predominance of marls and chalk.

There are a large number of temporary streams with an irregular flow, usually with highly mineralised water, many of them also eutrophicated. A very important feature of the area, particularly in recent times, is the very large demand of water for irrigation, and the increasing load of organic pollution of many of the surface waters in the basin, especially in the lower reaches of the rivers and streams. All these factors combine to produce a situation of high environmental stress (anoxic waters, water deficit, etc.).

The river Segura basin includes also a large number of hypersaline habitats, which in European context are of special rarity and of high conservation value.

**SAMPLING.** We have been collecting data of the presence/absence and relative abundance (when available) of water beetles in general, and of Hydradeephaga in particular, in 382 sampling stations distributed through the river Segura basin since 1980. In total, 116 out of a total of 231 UTM grid cells (10x10 km) of the basin have been prospected (fig. 1), i.e. approximately 50% of its surface. However, the stratified sampling has included the whole diversity of water bodies within the basin. Assuming our sampling is truly representative of the diversity of the area, we considered that species appearing in a maximum of two 10x10 km grid cells are rare.

We distinguished four main sampling periods since 1980: 1) 1980-1985, 2) 1986-1991, 3) 1992-1996, and 4) 1997-present. Sampling before 1994 included all macroinvertebrates and was not focused on water beetles. Despite the unavoidable differences in sampling methods, effort, etc. of such a long period of time, most of the data are estimates of relative abundance obtained with an entomological net of similar characteristics (pentagonal or triangular, 20-30 cm deep, with a mesh of 250 mm to 1 mm). In all cases the sampling was stratified, including all apparent habitat types considered, suitable for aquatic Coleoptera until no more new species were found (Millán et al., 2002). The information gathered in all these sampling periods was complemented with an exhaustive literature search.

To characterise the sites, 13 environmental variables were considered, six of them physical (altitude, water persistence, water depth, current speed, main substratum, type of sediment), three biological (dominant vegetation, percentage of macrophyte cover, riparian vegetation), and four chemical (conductivity, type and degree of mineralisation, dissolved oxygen, organic pollution) (Millán et al., 1996).



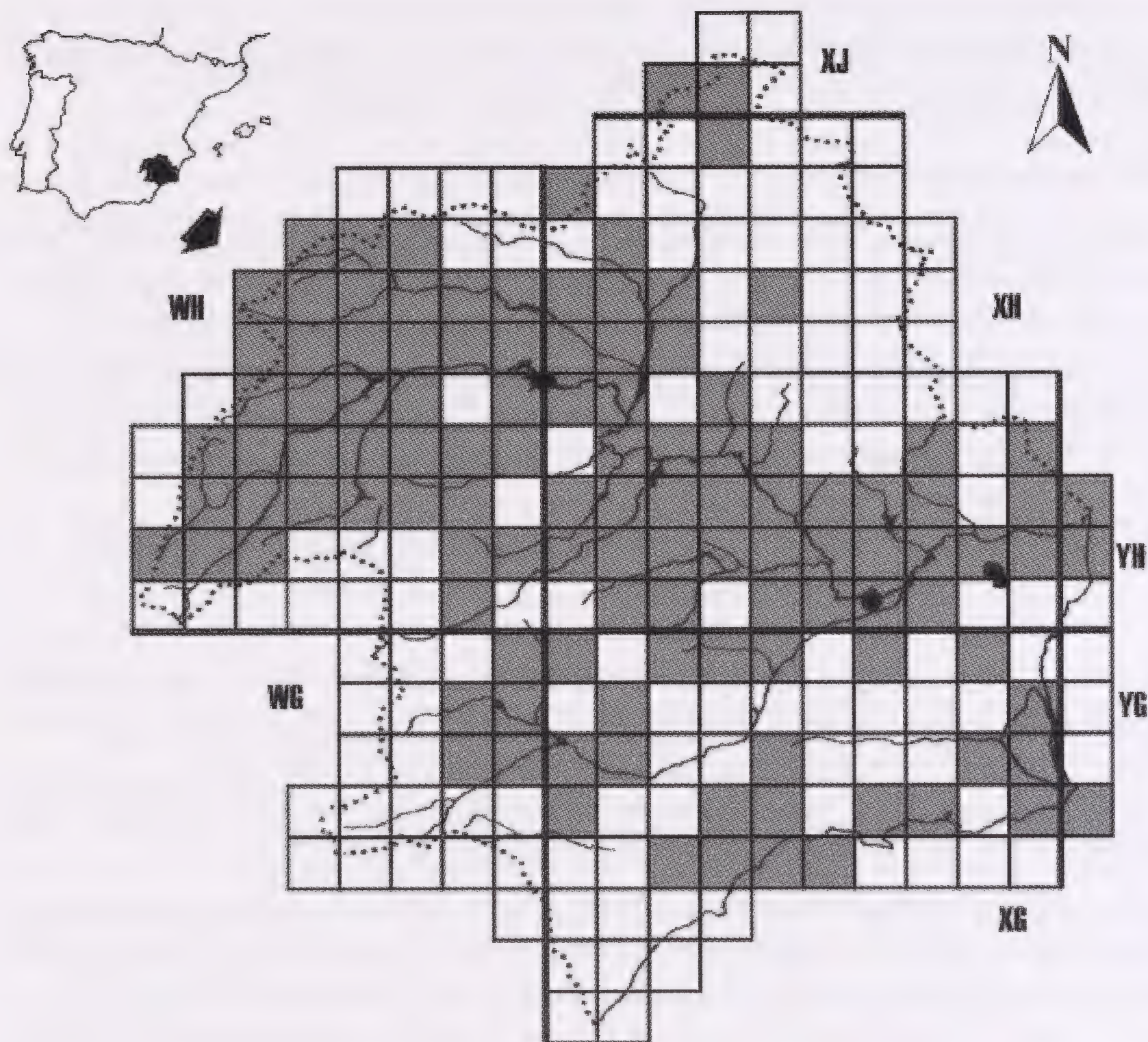


Fig. 1. Location of the Segura Basin and sampled 10 x 10 km UTM grid cells.

FAUNISTICAL STUDY. We used the program *Stimates* (v. 7) to obtain an estimate of the total number of species present in the basin. We used a species/samples accumulation curve, and the average value of the Mao Tau model (Colwell et al., 2004). Once the accumulation curve was obtained, we used the program *Curve Expert V. 1.34* (Copyright 1995-1997 by Daniels Hyams) to estimate an asymptote.

The list of species (tab. 2) follows the systematic and or the nomenclature of the Fauna Europaea Web Service (2005).

BIOGEOGRAPHY. Analyses of the distribution of the species was based on the chorological categories used by Ribera et al. (1998), modified by Millán et al. (2002), in which five different distributional types are distinguished:

Ibero-African species (S): present in the Iberian peninsula and in north Africa, but not north of the Pyrenees (except, occasionally, a small area in south France, in which case it is noted in the text).

Ibero-European species (N): present north of the Pyrenees and in the Iberian peninsula, but not south of it (i.e. in North Africa).



Species with a disjoint distribution (D): species present in the Iberian peninsula or the Balearic islands, and in some isolated areas in Europe (either mountain areas – boreo-Alpine species – or coastal areas in the eastern Mediterranean).

Endemic species (E): species restricted to the Iberian peninsula, with in some cases a small extension to some areas on the northern side of the Pyrenees or in southern France.

Trans-Iberian species (T): species present in the Iberian peninsula, in Europe north of the Pyrenees, and in North Africa.

To compare the fauna of Hydradeephaga of the Segura basin with that of other areas in the western Mediterranean data was compiled from Millán (1991), Millán et al. (1992) and Ribera et al. (2003), updated with the Palaearctic catalogues of Dytiscidae and Noteridae (Nilsson, 2003, 2004).

The areas considered were: P.I, Iberian peninsula; MAG, Maghreb; FRA, France; ITA, Italy; G.B, Great Britain; P.E, Scandinavian peninsula (Norway and Sweden); P.B, Balcanic peninsula (former Yugoslavia and Albania).

Within the Iberian peninsula, the main river basins considered were: CON, North basin; CDU, Duero basin; CTA, Tajo basin; CGA, Guadiana basin; CGR, Guadalquivir basin; CSU, south Basin; CSE, Segura basin; CJU, Júcar basin; CEB, Ebro basin; CPO, Oriental Pyrenees basin. The Balearic Islands (IBA) were considered an independent area. Data was originally taken from Millán (1991), updated whenever necessary. The phenetic affinity among basins and geographical areas was analysed using hierarchical classification methods implemented in Statistica (v. 4.5).

**ECOLOGY.** With the aim of identifying the main factor determining the spatial distribution of the species of Hydradeephaga in the Segura basin we compiled a presence/absence matrix of species x stations. The quantitative and qualitative environmental characteristics of the stations are listed in tab. 1. The final matrix species x environmental characteristics (build as a contingency table with the frequency of the presence of each species in each category of the environmental variable) was analysed through Correspondence Analysis (CA), a standard method for analysing contingency tables (e.g. Millán et al., 1996). The multivariate analysis was conducted using the statistical package SPAD.N (Lebart et al., 1984).

**CONSERVATION.** The degree of vulnerability of the species was estimated through a scoring system based on the combination of six criteria, both referring to the characteristics of the species and the habitats, following Abellán et al. (2005a). These criteria were: general distribution (GD), endemism (E), rarity of the species (RS), persistence (P), rarity of the habitat (RH) and habitat loss (HL). For each of these criteria species could score from 0 to 3, with increasing values as the estimated vulnerability increases. The sum of the scores in each of the criteria gives the total vulnerability value, which has a potential range between 0 and 18. This single score allows the linear ordination of all species of the Segura basin in a single gradient of “vulnerability”. For practical purposes we have considered four categories within this continuous gradient of vulnerability: extreme  $\geq 13$ , high  $\geq 9$ , moderate  $\geq 5$  and low  $\leq 4$ .

To identify the stations with the highest conservation value we applied an index developed by Millán (1991), the “conservation interest” index (IC), using a combined criterion of richness and rarity of the water beetle fauna. The IC is a modification of the Rarity Quality Factor (RQF) proposed by Foster (1987) and Eyre & Rushton (1989).



## RESULTS

**FAUNISTICAL STUDY.** Of the 208 species of water beetles so far recorded from the Segura basin, 81 are Hydradephaga (tab. 2).

This corresponds to ca. 45% of the total of species of Hydradephaga found in the Iberian peninsula (182). Fourteen of them are considered to be rare within the basin, although most of these are not rare in an Iberian context.

There are no species endemic to the Segura basin, and only six Iberian endemisms are present (five species and one subspecies, tab. 2). This number is relatively small in comparison with other Iberian areas (tab. 3).

The first records of Hydradephaga species from the Segura basin are those in Kraatz (1869) (*Hydroporus pubescens*) and de la Fuente (1894) (*Orectochilus villosus*), although it was not until the end of the 20th century that the knowledge of its fauna could be considered to be minimally developed, particularly with the work of Carlos Montes and collaborators in the 1980's, when the knowledge of the water beetles of the Segura basin could be said to have started. Developments in the knowledge of the fauna in the basin since this time is represented in fig. 2, where they are divided into four periods noted in the Methods section. The increase in the number of species following the third period, when the sampling was made more specific for water beetles, is apparent.

The cumulative curve of species richness is presented in fig. 3. The best asymptotic fit was that of the sub-logistic model of Morgan-Mercer-Flodin (MMF) (Morgan et al., 1975), with a high correlation coefficient ( $r = 0.999$ ) (standard deviation  $S = 0.232$ ). The model is highly parametrised, with the formula  $Y = ab + cxd/b + xd$  (estimation of the parameters:  $a = -2.558$ ,  $b = 15.119$ ,  $c = 90.912$  and  $d = 0.733$ ). The parameter  $c$  corresponds to the asymptote, i.e. the expected maximum number of species – approximately 91. According to this estimation, there are thus still ca. ten species of Hydradephaga to be recorded from the Segura basin.

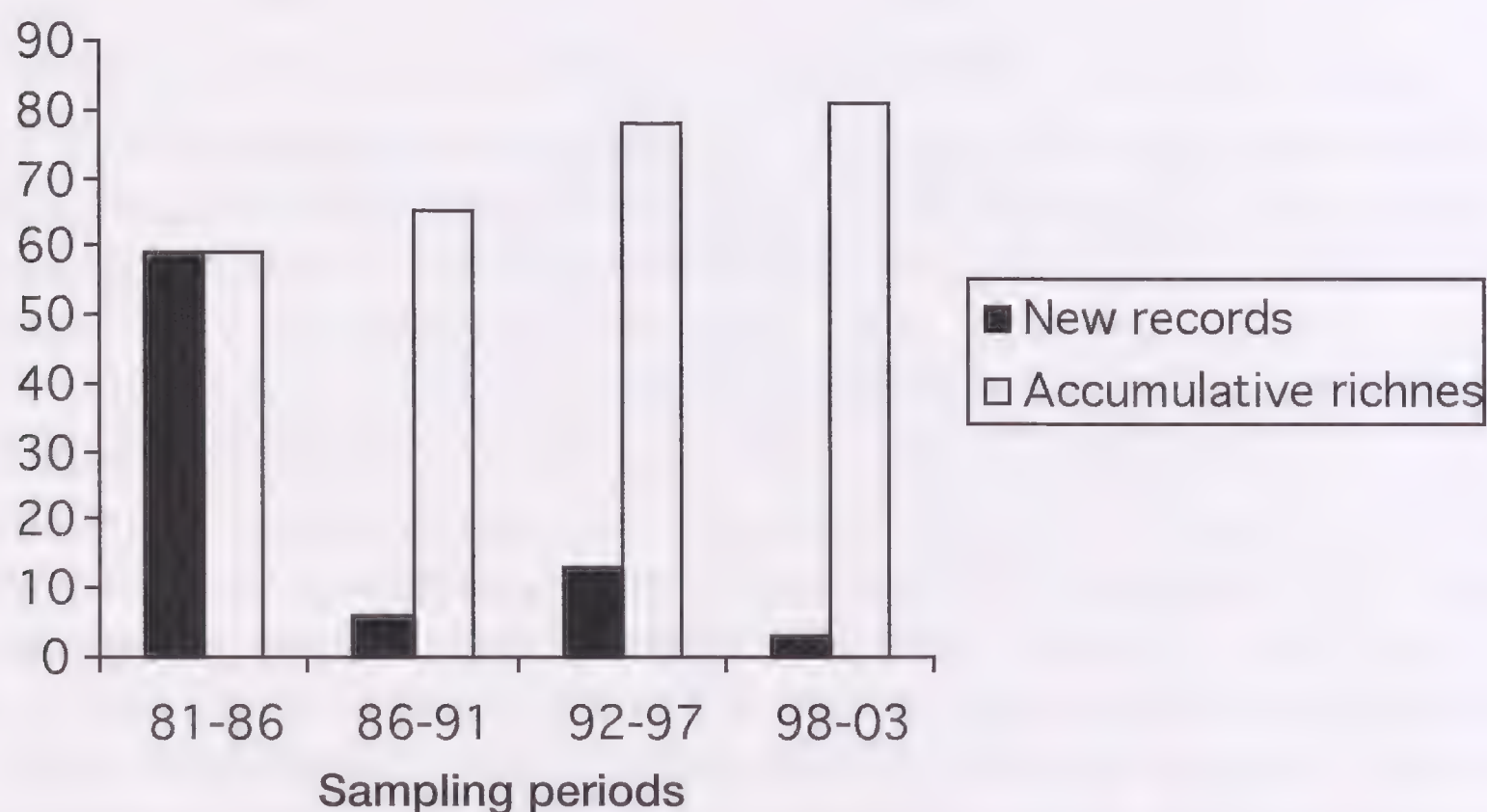


Fig. 2. Evolution of the knowledge of the Hydradephagan fauna in the Segura basin in the four periods explained in the text (see Methods).



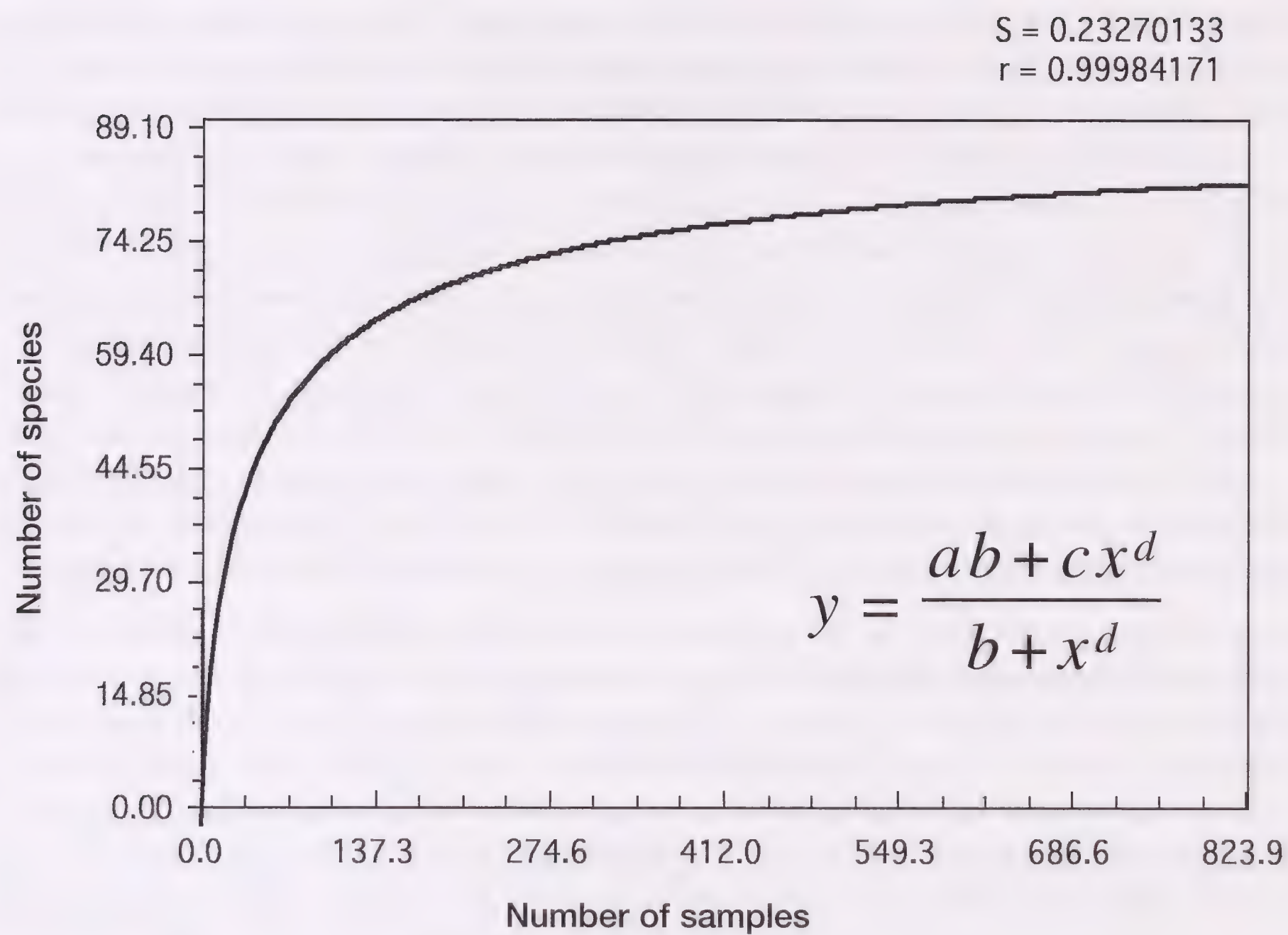


Fig. 3. Accumulative curve of species of Hydradephaga in the Segura Basin. The formula corresponds to the best estimation fitting the curve (i.e. a Morgan-Mercer-Flodin model, see text for details).

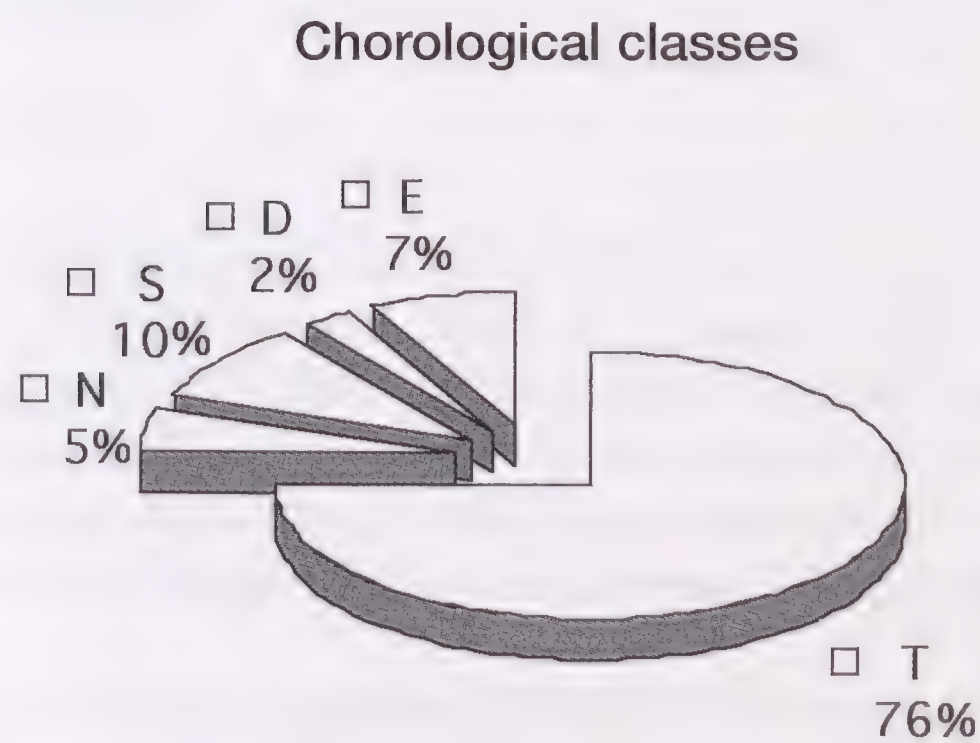


Fig. 4. Percentage of species belonging to the chorological classes considered. Symbols: T: Transiberian species; N: Ibero-European species; Ibero-African species; D: species with a disjoint distribution; E: Endemic species.



BIOGEOGRAPHY. Similarly to the wider Iberian fauna (Ribera, 2000), the majority of species in the Segura basin have a trans-Iberian distribution (fig. 4). The second most frequent category is that of the southern species, with a relatively small representation of Iberian endemics.

The phenetic hierarchy of relationships among the western-Palaeartic regions considered shows a clear similarity of the fauna of the Segura basin with that of the Maghreb (fig. 5). Together with the rest of the Iberian fauna, these three regions form a well defined group isolated from the rest of the European areas. Within the latter there is a certain grouping according to latitude, with the Mediterranean (Italy and the Balkans) and northern regions (Great Britain and Scandinavia) forming respective clusters. France is placed more as a transition region, although with higher affinities with the Mediterranean fauna.

Within the Iberobalea region there is also a clear north-south division, with a secondary classification into western and eastern basins (fig. 6). The Balearic islands seem to be a relatively independent biogeographical unit, although more related with the southern cluster.

ECOLOGY. The first axis of the CA analysis of the contingency matrix of species x environmental characteristics explained a large proportion of the variance (43%) (tab. 4), and could be related to a general longitudinal gradient, from species typical of the upper (negative values) to those typical of the lower reaches of the Segura basin. Environmental characteristics associated with the positive values of the axis are low altitude, moderate to high mineralisation and a high degree of eutrophication (Tabs 1-2; figs 7-8 – for clarity, we have represented separately the scores of the species and environmental characteristics). Although some of the species associated with the positive side of the axis are species with a wide distribution within the basin, they are considered to be typical of moderately saline waters, with a high load of organic eutrophication and standing or slowly running water.

Species significantly associated with the negative part of the axis are typical of high altitude, well developed riparian and macrophyte vegetation, and very low mineralization of the water (tabs 1-2; figs 7-8).

For practical purposes, four loose groups of species were defined according to the scores in the main ordination axis (fig. 7):

Group 1: Exclusively composed of *Nebrioporus ceresyi*, which is found in saline or hypersaline standing waters (fig. 7).

Group 2: *Nebrioporus baeticus*, *Laccophilus poecilus* and *Hydroglyphus signatellus* (fig. 7). Typical of running water in the lower reach of the basin, with moderate to high salinity, with a high content of organic matter (either highly polluted or eutrophied water) and scarce riparian vegetation (reed or *Arundo donax*). Two additional species, *Hydroporus limbatus* and *Herophydrus musicus* (fig. 7), could be considered to be close to this group due to the high degree of mineralization that they can withstand, although they prefer standing waters.

Group 3: *Laccophilus minutus*, *Hygrotus confluens*, *Hyphydrus aubei*, *Rhantus suturalis*, *Hydaticus leander*, *Eretes griseus* and *Noterus laevis* (fig. 7). Typical of temporary standing water bodies (or with strong seasonal level fluctuations), with abundance of fine sediment and organic matter, but with a lower degree of mineralization. Also with scarce or poorly developed riparian vegetation (reed or *Arundo donax*).



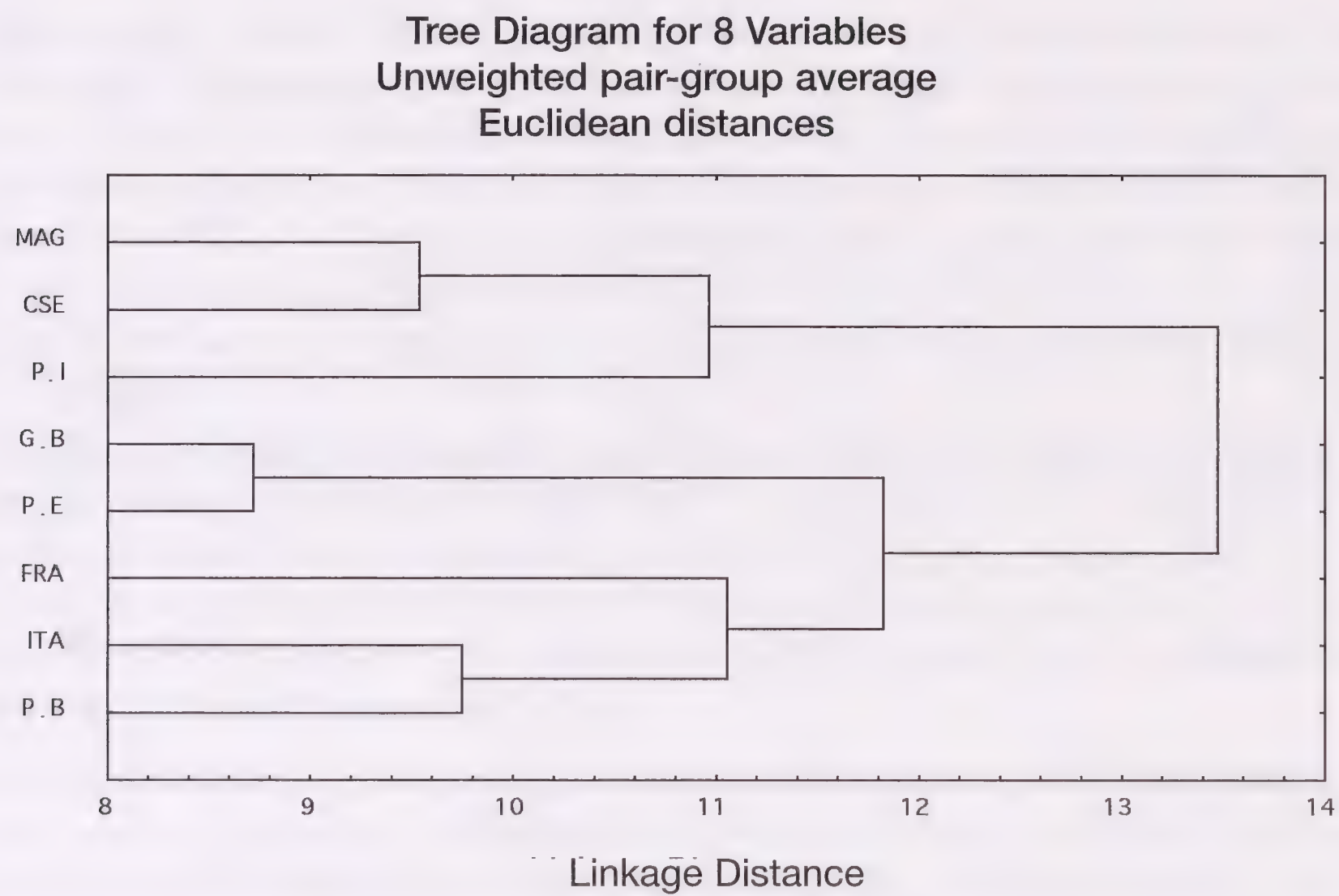


Fig. 5. Phenetic relationships of the Palearctic areas according to their Hydradephagan fauna. Symbols: P.I, Iberian peninsula; CSE, Segura Basin; MAG, Magreb; FRA, France; ITA, Italy; G.B, Great Britain; P.E, Scandinavian peninsula; P.B, Balcanic peninsula.

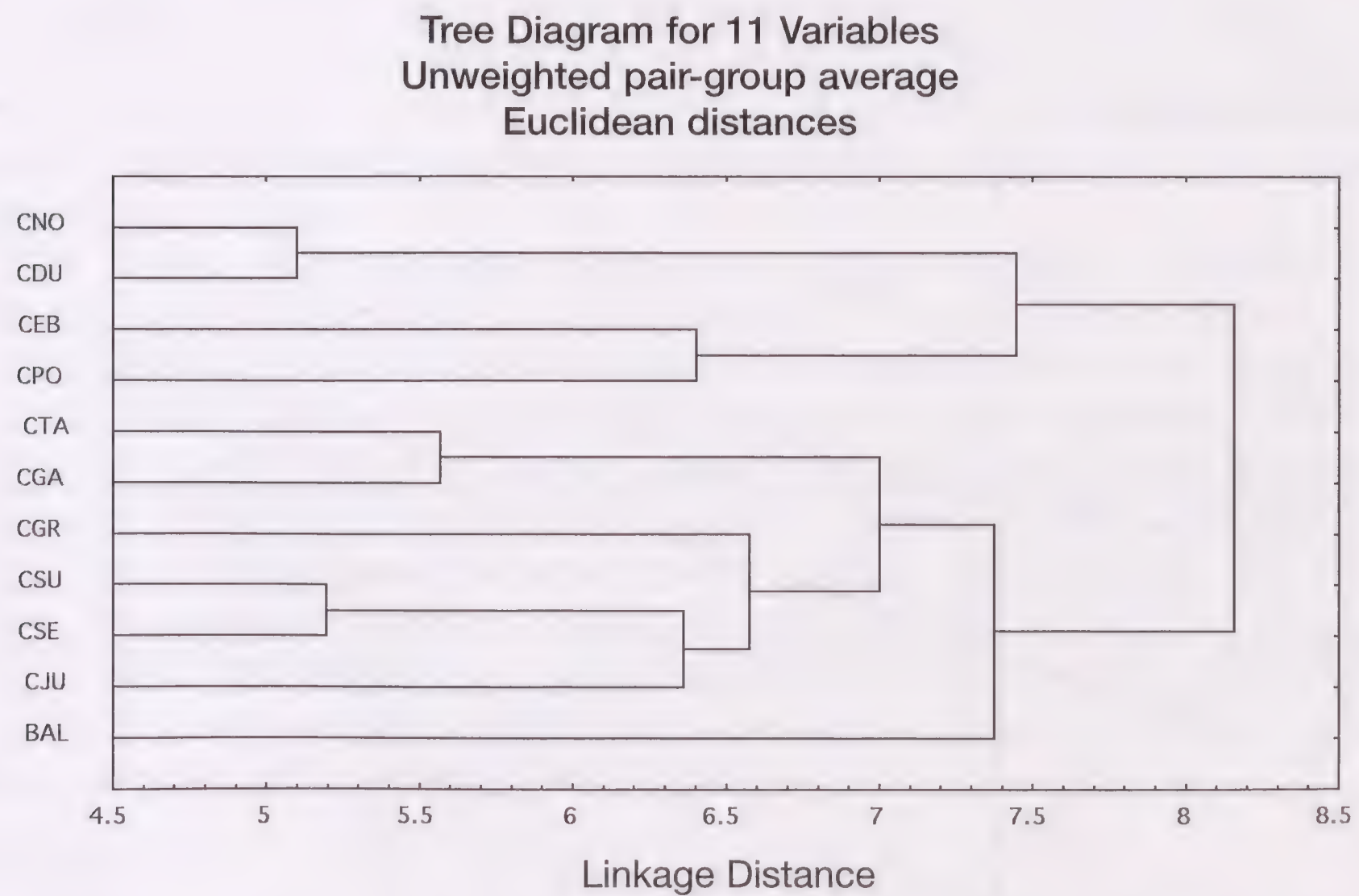


Fig. 6. Phenetic relationships of the river basins in the Iberian peninsula according to their Hydradephagan fauna. Symbols: CNO, North basin; CDU, Duero basin; CTA, Tajo basin; CGA, Guadiana basin; CGR, Guadalquivir basin; CSU, South Basin; CSE, Segura basin; CJU, Júcar basin; CEB, Ebro basin; CPO, Oriental Pyrenees basin; BAL, Balearic Islands.



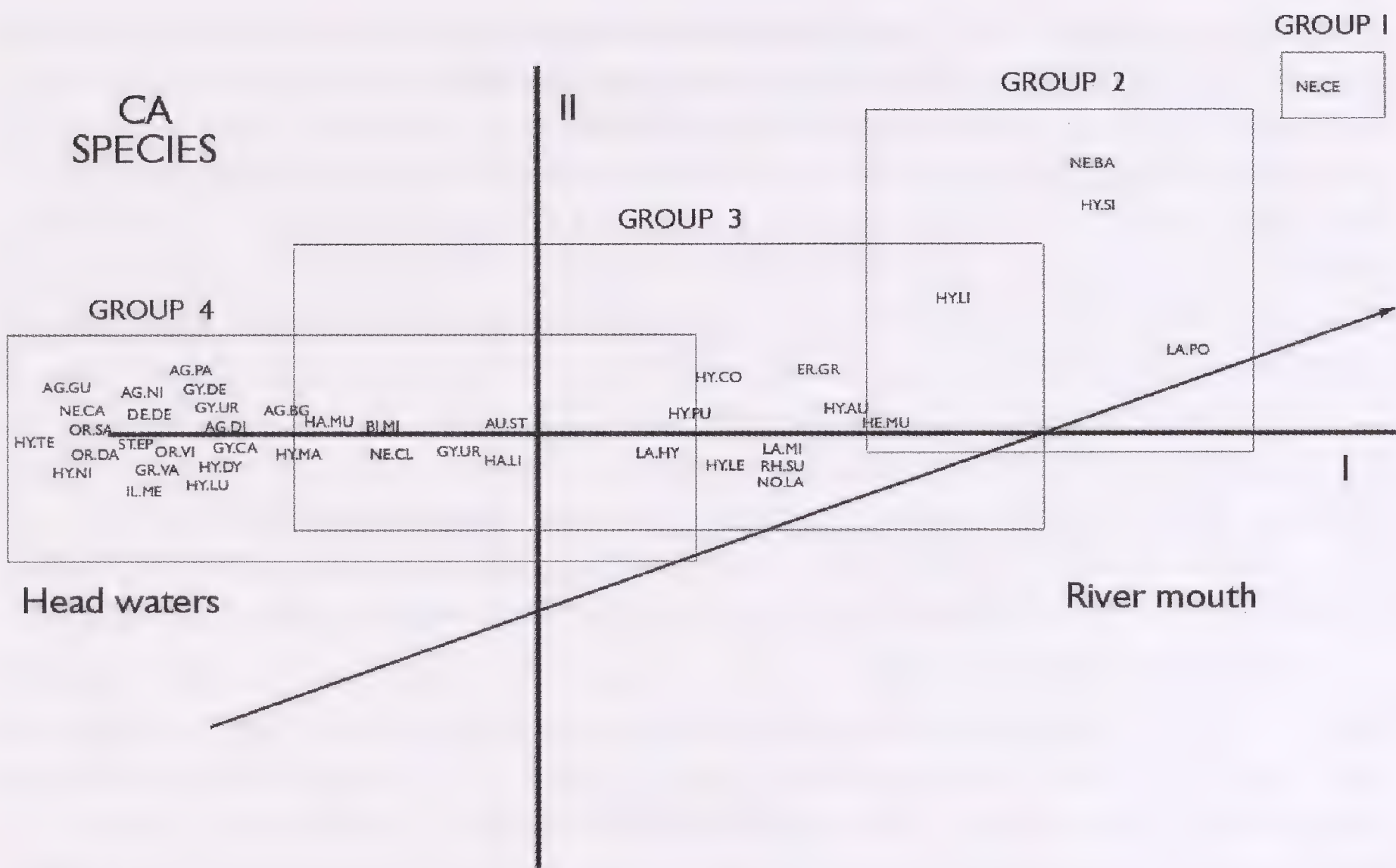


Fig. 7. Ordination plot of the species (axis I by axis II) in the Correspondence Analysis of the species x environmental characteristics matrix. See table 2 for the identification codes of the species.

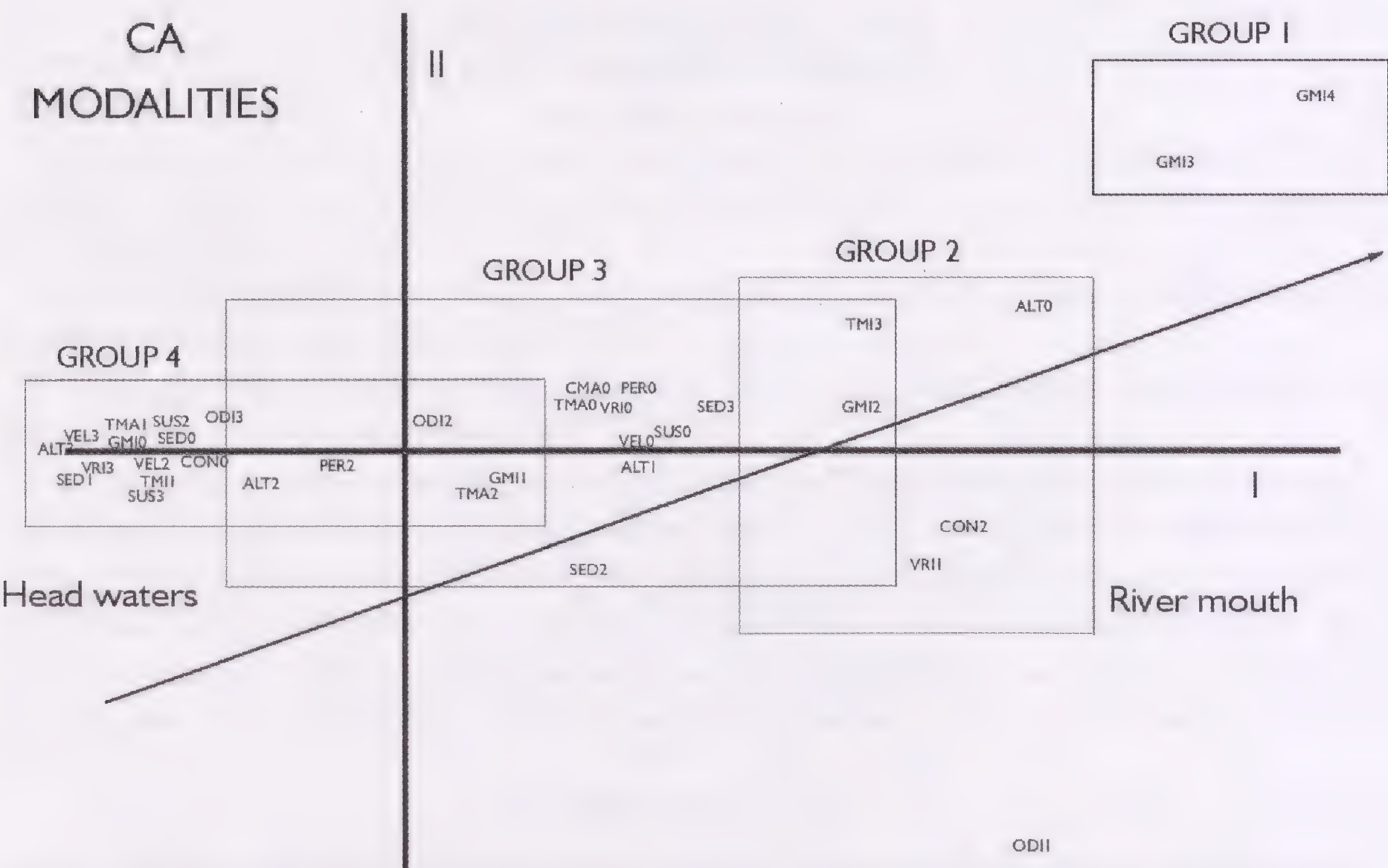


Fig. 8. Ordination plot of the range of environmental variables (axis I by axis II) in the Correspondence Analysis of the species x environmental characteristics matrix. See Table 1 for the identification codes of the variables.



**Group 4:** The most numerous, including *Dytiscus circumflexus*, *Hydroporus nigrita*, *H. discretus*, *H. marginatus*, *H. lucasi*, *Oreodytes davisii*, *O. septentrionalis*, *Gyrinus caspius*, *G. dejeani*, *G. distinctus*, *Orectochilus villosus*, *Nebrioporus bucheti cazorlensis*, *Stictonectes epipleuricus*, *Deronectes depressicollis*, *D. moestus*, *Agabus didymus*, *A. paludosus*, *A. nitidus*, *A. biguttatus*, *A. guttatus* and *Iliybius meridionalis* (fig. 7). They are all typical of the headwaters of the basin, in sites above 500 m of altitude, running, clean, fresh and well oxygenated waters, with coarse substratum and well developed riparian vegetation.

Finally, a number of species had a wide distribution within the basin, without clear associations with any type of habitat (i.e. with near zero scores in the CA axis, fig. 7). They include *Laccophilus hyalinus*, *Haliphus lineatocollis*, *H. mucronatus*, *Hydroglyphus pusillus*, *Bidessus minutissimus*, *Aulonogyrus striatus*, *Gyrinus urinator* and *Nebrioporus clarkii*. They can be considered as intermediate between groups 3 and 4, although they seem to prefer waters of low mineralisation.

**CONSERVATION.** Of the 81 species of Hydradephaga recorded from the Segura basin, only *Hydroporus decipiens* had a vulnerability value considered to be high (9), due to its rarity within the basin and to its restricted distribution (tab. 5). With a similar value (8), *Nebrioporus baeticus* is more representative of the fauna of the basin, as it is a typical inhabitant of saline running waters. These are highly endangered habitats, due to the increase in the use of irrigation in the surrounding fields, which use the natural drainage system (with the saline streams) to evacuate the excess of irrigation water.

A number of species had estimated values of vulnerability between 7 and 5, mostly because of their restricted distribution (they are Iberian endemics, such as *Graptodytes castilianus*, *Deronectes depressicollis* and *Nebrioporus bucheti cazorlensis*), or their rarity within the Segura basin (e.g. *Agabus guttatus*, *Oreodytes davisii*, *Hydroporus nigrita* and *Stictonectes lepidus*).

The stations with the highest conservation interest were mountain streams in the NW of the basin (tab. 6): Río Endrinales en Las Espinera, Arroyo de Fuenfría, Río de la Vega, Río Endrinales, Nacimiento del río Madera, Chorros del río Mundo and Río Zumeta en Santiago de la Espada. Only three stations with a high IC were ecologically different from the group above: Laguna de Pétrola, Laguna del Salobralejo and Laguna de los Patos, the two first, endorreic lagoons with small associated freshwater streams, and the last, a well vegetate artificial lagoon. The same mountain streams also have a high conservation interest for other aquatic Coleoptera, mainly Hydraenidae (Delgado & Soler, 1991; Ribera & Hernando, 1998; Millán & Aguilera, 2000; Sánchez-Fernandez et al., 2004b; Abellán et al., 2005b), with some species exclusive to the basin or to the sierras de Alcaraz and Segura (including the headwaters of the river Segura).

## DISCUSSION

The Hydradephagan fauna of the Segura basin is one of the best known within the Iberian peninsula, as shown by the accumulation curves, but also from the number of records and the extensive sampling of their habitats. In relation to its area (18,815km<sup>2</sup>, one of the smaller Iberian river basins), the number of species is relatively high, with only the Ori-



ental Pyrenees basin being richer. The latter is a transition area between Europe and Iberia, and has been extensively sampled over a longer period (e.g. Rico et al., 1990).

As regards the composition of the Hydradephagan fauna of the Segura basin, of note is the predominance of species with wide distributions (trans-Iberian) and the low percentage of Iberian endemics. This is in contrast with another 11 groups of aquatic beetles, in which the south-east of the Iberian peninsula is one of the areas with the highest endemicity (e.g. Hydraenidae, Ribera, 2000). Most of the species are also widely distributed within the basin, with only 14 of them considered to be rare, most of them at the southern limit of their distribution, but common in northern areas within Iberia. The level of endemicity of the Hydradephagan fauna is not only low in comparison with that of other groups of aquatic Coleoptera, but low in comparison with other areas in Iberia, in particular in the north west (Ribera, 2000). The reasons for this uneven distribution of endemic species are at present unknown, and only more detailed studies on their origin (geographical and phylogenetic) can shed light on this interesting question. At the moment we can only speculate as to the possible role of the particular characteristics of the aquatic habitats in the Segura basin, with a prevalence of highly mineralised waters in which the Hydradephagan fauna is very poorly represented, in contrast to the high abundance and diversity of Hydraenidae (see e.g. Moreno et al., 1997). The richest fauna of Hydradephaga is found in the freshwater streams of the mountain areas, although these habitats are relatively scarce and limited to the headwaters – and increasingly threatened because of the expansion of agriculture and increased human pressure.

At a wider scale, the Hydradephagan fauna of the Segura basin shows greater affinities with that of north Africa than with adjacent areas within the Iberian peninsula or in Europe. The biogeographical connections between the SE Iberia and the Rif are well known, both for plants and animals (Sanz de Galdeano, 1996; Médail & Quézel, 1997). There were multiple land connections between the two areas during the Miocene up to the end of the Messinian crisis, with the separation of the Iberian peninsula and north Morocco after (5.33 MY) the re-opening of the Gibraltar straits (Krijgsman et al. 1999). Other than these historical affinities, the similarity of the available aquatic habitats in the Segura basin and in north Morocco is without doubt another factor contributing to the similarity of their faunas. The heterogeneity of the Iberian fauna of aquatic Coleoptera was already noted by Ribera (2000), with a clear separation between the northern areas (with a predominantly European fauna) and the southern ones (more related to the north African faunas).

Among the European regions, the clear north-south divide is probably the results of a similar mixture of historical and present-day ecological factors, with the Quaternary glaciations probably having a decisive impact on the distribution of many of the species (e.g. Coope, 1995; Hewitt, 1996).

The ordination method used here to link the presence/absence of the species with the environmental characteristics of the habitats in which they occur has proven particularly useful. Other methods previously used did not explain such a high percentage of the variance (more than 40% for the first axis), or were more difficult to interpret (e.g. Millán et al., 1996). Of the studied environmental characteristics, altitude, degree of mineralization of the water, and amount and type of riparian vegetation seem to have had the highest impact on the composition of the Hydradephagan fauna. This is similar to the



finding of previous studies on communities of Hydradephaga in the Iberian peninsula (e.g. Garrido et al., 1994; Ribera et al., 1996), but is particularly important in the Segura basin, where there is a wide range of ecological conditions, and a large proportion of highly mineralised water bodies due to both the soil type and the general climatology. The amount and type of riparian vegetation is likely to play more of a structural role, conditioning the availability of refugia, the suitability of oviposition sites and the presence of prey (e.g. Millán et al., 1996).

The methodology used here to identify species considered to be vulnerable incorporates a degree of arbitrariness, but this is a common feature of all proposed criteria for conservation (e.g. Millsap et al., 1990; Cofré & Marquet, 1998; IUCN, 2001). Our criteria summarise factors generally acknowledged to be of relevance in determining the probability of extinction, such as restricted distribution, habitat specificity, habitat loss or scarcity of populations (Gaston, 1994). Our scoring method allows a range of between 0 and 18, but it seems very unlikely that a species could score anywhere near 18, not only among Hydradephaga but even among other groups with a higher proportion of very narrow endemics (Sánchez-Fernández et al., 2003; Abellán et al., 2005a) (which, to a certain extent, is a validation of our criteria, it could be argued that all species near the highest level of vulnerability are already extinct). It seems more reasonable to consider that species with intermediate scores have a high degree of vulnerability. A common problem to all these scoring systems is the lack of independence of the different criteria (for example, a species occurring in only one station is necessarily restricted to one habitat). In some cases this could be solved through the use of information on the general distribution or ecology of the species, but in some others the knowledge of the species is not enough to allow a sound analysis of its conservation status. This is probably the case with *Hydroporus decipiens*, which had the highest vulnerability score among the Hydradephaga of the Segura basin (collected only once, in 1997). The taxonomic identity and distribution of this species is still unclear, and so any evaluation of its conservation status is premature.

The species with the second highest vulnerability score, *Nebrioporus baeticus*, is, however, a very well known typical component of the regional fauna. It is widespread and locally very common in the saline streams in the SE of the Iberian peninsula (Millán et al., 2002), but can also be found in similar habitats in the central and upper Ebro basin. The main factor threatening its populations is human impact: due to its high habitat specificity, any alteration is potentially highly damaging. Although relatively widespread in the Segura basin, saline streams are highly endangered due to the increased irrigation of the surrounding land (which results in an increasing loss of salinity of the water), the direct effluent of residual waters, and the diffuse contamination from human settlements (Abellán et al., in press).

Other species with a relatively high vulnerability score must be considered endangered only at a regional level, such as those at the southern limit of their distributions. This is the case of *Agabus guttatus*, a typical inhabitant of small freshwater streams in most of Western Europe, including the north of the Iberian peninsula (Rico et al., 1990).

In what refers to the selection of the habitats with the highest conservation priority, the results obtained here using only Hydradephaga, are very similar to those obtained with a wider representation of the fauna (i.e. a predominance of mid-altitude freshwater



streams, Ribera, 2000; Sánchez-Fernández et al., 2004b). Furthermore, the Hydradephaga can be considered a good representation of the general beetle fauna (Sánchez-Fernández et al., 2004b), at least under the criteria of species richness and rarity used here.

An inconvenience of the index applied in this paper (IC) is the lack of reference to the conservation interest of the habitats outside the study area. Thus, the saline or hyper-saline streams (“ramblas”) (Millán et al., 1996; Moreno et al., 1997), which are extremely rare in an European (or even global) context, are not considered of particular relevance due to the poor richness of species and local abundance of their typical species. The use of other criteria for the selection of sites of conservation value could overcome this limitation, such as complementarity (Sánchez-Fernández et al., 2004a; Abellán et al., 2005b). As there is almost no overlap between the community of freshwater mountain streams and the community of saline “ramblas”, complementary criteria always choose representative sites of both types of habitat.

During these 25 years of study, we have gathered a wealth of information on the distribution and ecology of the Hydradephagan fauna of the Segura basin. We now plan to continue completing our knowledge of the group (and of other groups of aquatic Coleoptera) through a study of the detailed ecological traits of the species, trophic relationships, metapopulation distribution and phylogentic and phylogeographic relationships between species and populations.

#### ACKNOWLEDGEMENTS

We would like to express our gratitude to the many people who have contributed to this work over the years, too numerous to detail here. In particular, we thank Carlos Montes and Luis Ramírez for setting the foundations for the study of the Segura basin. We also would like to thank the late Mario Franciscolo for his inspiring monograph on Hydradephaga. Moreover, Mr. Philip Thomas (University of Murcia) is thanked for the linguistic revision of the manuscript.

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Tab. 1. Ranges of biotic and abiotic parameters measured. Codes: ALT: altitude; PER, water persistence; VEL, current speed; SUS, substrate; SED, sediment; TMA, macrophyts; CMA, macrophyts cover; VRI, riparian vegetation; GMI, mineralisation and conductivity; TMI, mineralisation type; ODI, dissolved oxygen; CON, organic pollution. The codes are those used in fig. 8. CPOM, coarse particulate organic matter; FPOM, fine particulate organic matter; UPOM, ultra-fine particulate organic matter.

<b>ALTITUDE (m)</b> <b>(ALT)</b>	<b>WATER PERSISTENCE</b> <b>(PER)</b>	<b>WATER DEPTH (cm)</b> <b>(PRO)</b>	<b>CURRENT SPEED (cm/s)</b> <b>(VEL)</b>	
0 0-20	0 Temporal	0 0-15	0 Standing water	
1 >20-400	1 Permanent/fluctuating	1 >15-50	1 Slow: <15 cm/s	
2 >400-1000	2 Permanent	2 >50	2 Moderate: 15-50 cm/s	
3 >1000			3 High: >50 cm/s	

<b>SUSBTRATE</b> <b>(SUS)</b>	<b>SEDIMENT</b> <b>(SED)</b>	<b>MACROPHYTS</b> <b>(TMA)</b>	<b>MACROPHYTS (%)</b> <b>(CMA)</b>	
0 Silt & clay	0 Absence	0 Absence	0 Absence	
1 Sand	1 CPOM	1 Bryophytes	1 5-10	
2 Gravel	2 FPOM	2 Filamentous algae	2 >10-30	
3 Boulder/pebble	3 UPOM	3 Charophytes	3 >30-70	
4 Rock/cement		4 Phanerogams	4 >70	

<b>RIPARIAN VEGETATION</b> <b>(VRI)</b>	<b>MINERALISATION: S (g/l),</b> <b>(GMI)</b>	<b>CONDUCTIVITY (µS/cm)</b>	
0 Absence	0 Freshwater:	<0,5	<800
1 Arundo & Phragmites	1 Subsaline:	0,5-3	800-8000
2 Juncus/Typha/Taray	2 Mesosaline:	>3-20	8000-30000
3 Salix/Populus/Ulmus	3 Saline:	>20-40	30000-60000
	4 Hypersaline:	>40	>60000

<b>MINERALISATION TYPE</b> <b>(TMI)</b>	<b>DISSOLVED OXYGEN (mg/l)</b> <b>(ODI)</b>	<b>ORGANIC POLLUTION</b> <b>(CON)</b>	
0 Ionic equilibrium	0 Anoxic: 0-2	0 Clean waters	
1 Carbonates	1 Low: 2-5	1 Eutrophic waters	
2 Sulfates	2 Medium: 5-12	2 Moderately polluted waters	
3 Sodium Chloride	3 High: >12	3 Very polluted waters	



Tab. 2. Species of Hydradephaga recorded from the Segura basin. The list is taxonomically sorted according to Ribera et al. (1998), to facilitate the comparison with the wider Iberian fauna. E, Iberian endemic species; R, species considered to be rare within the Segura basin (i.e., recorded from no more than two 10x10 km grid cells). The codes are those used in fig. 7. (\*) specimens of uncertain status.

GYRINIDAE			
1	<i>Gyrinus (Gyrinus) caspius</i> Ménétriés, 1832		GYCA
2	<i>Gyrinus (Gyrinus) dejeani</i> Brullé, 1832		GYDE
3	<i>Gyrinus (Gyrinus) distinctus</i> Aubé, 1838		GYDI
4	<i>Gyrinus (Gyrinus) urinator</i> Illiger, 1807		GYUR
5	<i>Aulonogyrus striatus</i> (Fabricius, 1792)		AUST
6	<i>Orectochilus villosus</i> (O.F. Müller, 1776)		ORVI
HALIPLIDAE			
7	<i>Peltodytes rotundatus</i> (Aubé, 1836)		PERO
8	<i>Haliphus (Haliplidius) obliquus</i> (Fabricius, 1787)		HAOB
9	<i>Haliphus (Neohaliphus) lineatocollis</i> (Marsham, 1802)		HALI
10	<i>Haliphus (Liaphlus) mucronatus</i> Stephens, 1832		HAMU
NOTERIDAE			
11	<i>Noterus laevis</i> Sturm, 1834		NOLA
HYGROBIIDAE			
12	<i>Hygrobia hermanni</i> (Fabricius, 1775)	(R)	HYHE
DYTISCIDAE			
13	<i>Laccophilus hyalinus</i> (De Geer, 1774)		LAHY
14	<i>Laccophilus minutus</i> (Linnaeus, 1758)		LAMI
15	<i>Laccophilus poecilus</i> Klug, 1834		LAPO
16	<i>Hyphydrus aubei</i> Ganglbauer, 1892		HYAU
17	<i>Hydrovatus cuspidatus</i> (Kunze, 1818)		HYCU
18	<i>Yola bicarinata</i> (Latreille, 1804)		YOBI
19	<i>Bidessus minutissimus</i> (Germar, 1824)		BIMI
20	<i>Bidessus pumilus</i> (Aubé, 1838) (R)		BIPU
21	<i>Hydroglyphus geminus</i> (Fabricius, 1792)		HYGE
22	<i>Hydroglyphus signatellus</i> (Klug, 1834)		HYSI
23	<i>Hygrotus (Coelambus) confluens</i> (Fabricius, 1787)		HYCO
24	<i>Hygrotus (Coelambus) impressopunctatus</i> (Schaller, 1783)		HYIM
25	<i>Hygrotus (Coelambus) lagari</i> (Fery, 1992)		HYLA
26	<i>Hygrotus (Coelambus) pallidulus</i> (Aubé, 1850)		HYPA
27	<i>Herophydrus musicus</i> (Klug, 1833)		HEMU
28	<i>Hydroporus decipiens</i> Sharp, 1877	(E)	(R) HYDE
29	<i>Hydroporus discretus</i> Fairmaire & Brisout, 1859		HYDI
30	<i>Hydroporus limbatus</i> Aubé, 1838		HYLI
31	<i>Hydroporus lucasi</i> Reiche, 1866		HYLU
32	<i>Hydroporus marginatus</i> (Duftschmid, 1805)		HYMA
33	<i>Hydroporus nigrita</i> (Fabricius, 1792)		HYNI
34	<i>Hydroporus normandi</i> Régimbart, 1903		HYNO
35	<i>Hydroporus planus</i> (Fabricius, 1781)	(R)	HYPL



36	<i>Hydroporus pubescens</i> (Gyllenhal, 1808)				HYPU
37	<i>Hydroporus tessellatus</i> Drapiez, 1819				HYTE
38	<i>Graptodytes aequalis</i> Zimmermann, 1918				GRAE
39	<i>Graptodytes castilianus</i> Fery, 1995	(E)	(R)		GRCA
40	<i>Graptodytes fractus</i> (Sharp, 1882)				GRFR
41	<i>Graptodytes ignotus</i> (Mulsant, 1861)				GRIG
42	<i>Graptodytes varius</i> (Aubé, 1838)				GRVA
43	<i>Metaporus meridionalis</i> (Aubé, 1838)				MEME
44	<i>Stictonectes epipleuricus</i> (Seidlitz, 1887)	(E)			STEP
45	<i>Stictonectes lepidus</i> (Olivier, 1795)		(R)		STLE
46	<i>Stictonectes optatus</i> (Seidlitz, 1887)				STOP
47	<i>Deronectes depressicollis</i> (Rosenhauer, 1856)	(E)			DEDE
48	<i>Deronectes fairmairei</i> (Leprieur, 1876)				DEFA
49	<i>Deronectes hispanicus</i> (Rosenhauer, 1856)				DEHI
50	<i>Deronectes moestus</i> (Fairmaire, 1858)				DEMO
51	<i>Stictotarsus duodecimpustulatus</i> (Fabricius, 1792)		(R)		STDU
52	<i>Stictotarsus griseostriatus</i> (De Geer, 1774)		(R)		STGR
53	<i>Nebrioporus (Nebrioporus) bucheti cazorlensis</i> (Lagar, Fresneda & Hernando, 1987)	(E)			NECA
54	<i>Nebrioporus (Nebrioporus) clarkii</i> (Wollaston, 1862)				NECL
55	<i>Nebrioporus (Zimmermannius) baeticus</i> (Schaum, 1864)	(E)			NEBA
56	<i>Nebrioporus (Zimmermannius) ceresyi</i> (Aubé, 1838)				NECE
57	<i>Oreodytes davisii</i> (Curtis, 1831)		(R)		ORDA
58	<i>Oreodytes septentrionalis</i> (Gyllenhal, 1827)*		(R)		ORSE
59	<i>Agabus biguttatus</i> (Olivier, 1795)				AGBG
60	<i>Agabus bipustulatus</i> (Linnaeus, 1767)				AGBP
61	<i>Agabus brunneus</i> (Fabricius, 1798)				AGBR
62	<i>Agabus conspersus</i> (Marsham, 1802)				AGCO
63	<i>Agabus didymus</i> (Olivier, 1795)				AGDI
64	<i>Agabus guttatus</i> (Paykull, 1798)		(R)		AGGU
65	<i>Agabus nebulosus</i> (Forster, 1771)				AGNE
66	<i>Agabus nitidus</i> (Fabricius, 1801)				AGNI
67	<i>Agabus paludosus</i> (Fabricius, 1801)				AGPA
68	<i>Agabus ramblae</i> Millán & Ribera, 2001				AGRA
69	<i>Ilybius chalconatus</i> (Panzer, 1796)		(R)		ILCH
70	<i>Ilybius meridionalis</i> Aubé, 1837				ILME
71	<i>Ilybius montanus</i> (Stephens, 1828)		(R)		ILMO
72	<i>Rhantus (Rhantus) suturalis</i> (McLeay, 1825)				RHSU
73	<i>Colymbetes fuscus</i> (Linnaeus, 1758)				COFU
74	<i>Meladema coriacea</i> Castelnau, 1834				MECO
75	<i>Eretes griseus</i> (Fabricius, 1781)				ERGR
76	<i>Hydaticus (Guignotites) leander</i> (Rossi, 1790)				HYLE
77	<i>Dytiscus circumflexus</i> Fabricius, 1801				DYCI
78	<i>Dytiscus pisanus</i> Castelnau, 1834		(R)		DYPI
79	<i>Dytiscus semisulcatus</i> O.F. Müller, 1776		(R)		DYSE
80	<i>Cybister (Cybister) tripunctatus africanus</i> Castelnau, 1834		(R)		CYTR
81	<i>Cybister (Scaphinectes) lateralimarginalis</i> (De Geer, 1774)				CYLA



Tab. 3. Species richness and level of endemism of the Hydradephagan fauna of the main Iberian river basins. CNO, North basin; CDU, Duero basin; CTA, Tajo basin; CGA, Guadiana basin; CGR, Guadalquivir basin; CSU, South Basin; CSE, Segura basin; CJU, Júcar basin; CEB, Ebro basin; CPO, Oriental Pyrenees basin; BAL, Balearic Islands.

	CNO	CDU	CTA	CGA	CGR	CSU	CSE	CJU	CEB	CPO	BAL
Local endemism	1	2	3	0	1	0	0	0	1	0	3
Iberian endemism	13	14	11	6	8	5	6	4	14	5	4
Hydradephaga species richness	112	131	108	105	110	76	81	101	131	110	70
Area of basins (km <sup>2</sup> )	60224	111072	93289	74853	63085	18391	18815	42904	86098	16493	4964

Tab. 4. Eigenvalues, inertia, cumulative inertia and absolute contributions of species and environmental variables for the I and II axis of the CA.

CA	axis I		axis II	
Eigenvalues	0.17		0.04	
Inertia	0.43		0.10	
Cumulative inertia	0.43		0.54	
ABSOLUTE CONTRIBUTIONS				
Axis I				
Species		Modalities		
HA.LI	13.94	ODI1	11.26	
HE.MU	8.69	ALT0	8.30	
NO.LA	8.02	GMI3	6.97	
DY.CI	5.31	ALT3	6.64	
HY.MA	5.00	GMI2	6.05	
AG.DI	4.89	GMI4	5.96	
RH.SU	3.89	SED1	5.41	
		CON2	5.09	
		VRI1	4.93	
		VRI3	3.87	
		TMI3	3.79	
Axis II				
Species		Modalities		
RH.SU	23.95	ODI1	52.28	
AG.DI	20.44	GMI3	11.51	
HE.MU	19.53	GMI4	10.66	
HA.LI	16.87	ALT0	5.20	
DY.CI	8.16	SED2	4.57	
HY.MA	5.31			



Tab. 5. Scores of the variables used in the vulnerability analysis at local level for the species found in the study area.

Symbols: GD, general distribution; E, endemicity; RS, rarity of species; P, persistence; HR, habitat rarity; HL, habitat loss.

Species	GD	E	RS	P	HR	HL	V	Category
<i>Hydroporus decipiens</i>	3	2	3	1	0	0	9	High
<i>Nebrioporus baeticus</i>	3	1	1	0	0	3	8	Moderate
<i>Agabus guttatus</i>	1	0	3	2	0	1	7	Moderate
<i>Graptodytes castilianus</i>	3	1	3	0	0	0	7	Moderate
<i>Deronectes depresicollis</i>	3	2	1	0	0	0	6	Moderate
<i>Oreodytes davisii</i>	0	0	3	2	0	1	6	Moderate
<i>Stictonectes lepidus</i>	0	0	3	3	0	0	6	Moderate
<i>Hydroporus nigrita</i>	1	0	2	2	0	0	5	Moderate
<i>Nebrioporus bucheti cazorlensis</i>	3	1	1	0	0	0	5	Moderate

Tab. 6. Ranking of the 10 sites with the highest conservation interest using the IC index for the Hydradephaga species.

Symbols: S, richness; IC, “conservation interest” index.

Sites		S	IC
1	Río Endrinales en Las Espineras	28	108.20
2	Arroyo de Fuenfría	25	69.44
3	Laguna de Pétrola	21	48.22
4	Laguna del Salobralejo	17	36.76
5	Río de la Vega	22	35.09
6	Río Endrinales	18	33.81
7	Nacimiento del río Madera	19	28.58
8	Chorros del río Mundo	13	28.25
9	Río Zumeta en Santiago de la Espada	17	28.22
10	Laguna de los Patos	12	21.70

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Luis Felipe VALLADARES & David MIGUÉLEZ

**Primeros datos sobre la fauna de Coleópteros acuáticos  
de los humedales del acuífero de Los Arenales  
(Meseta Norte, España)  
(Coleoptera Adephaga y Polyphaga)**

**Resumen** - Se presentan los primeros datos de la fauna de Coleópteros acuáticos de las charcas del acuífero de los Arenales, una zona de meseta situada al sur del río Duero, en el Centro de España. Se han identificado 39 especies repartidas entre las familias Haliplidae (1), Dytiscidae (16), Helophoridae (6), Hydrophilidae (8), Hydraenidae (5), Dryopidae (1), Elmidae (1) y Heteroceridae (1), la mayoría de las cuales son nuevas citas para las provincias de Valladolid (27 de 34) y Segovia (8 de 11). Estos resultados muestran una fauna relativamente pobre, con una elevada proporción de especies transibéricas y sin endemismos ibéricos. Desde un punto de vista faunístico destacan las citas de *Hygrotus lagari* (Fery, 1992) y *Ochthebius meridionalis* Rey, 1885.

**Abstract** - First data about aquatic Coleoptera from the wetlands of the Los Arenales aquifer (North Iberian Plateau, Spain) (Coleoptera Adephaga and Polyphaga).

The first data about the fauna of aquatic Coleoptera from the pools of the Los Arenales aquifer are presented. This is a plateau area located to the south of the Duero River, in Central Spain. Thirty-nine species belonging to the families Haliplidae (1), Dytiscidae (16), Helophoridae (6), Hydrophilidae (8), Hydraenidae (5), Dryopidae (1), Elmidae (1) y Heteroceridae (1) were identified. Most of them are cited for the first time in the provinces of Valladolid (27 out of 34) and Segovia (8 out of 11). The results revealed a relatively poor fauna, with high proportion of transiberian species and without Iberian endemisms. Two of the records were remarkable from a faunistical point of view, *Hygrotus lagari* (Fery, 1992) and *Ochthebius meridionalis* Rey, 1885.

**Riassunto** - Primi dati sui Coleotteri acquatici delle aree umide dell'acquifero di Los Arenales (Plateau Nord Iberico, Spagna) (Coleoptera Adephaga e Polyphaga).

Sono forniti i primi dati sulla coleotterofauna acquatica di Los Arenales: un plateau situato a Sud del fiume Duero (Spagna centrale). Sono state identificate 39 specie appartenenti alle famiglie Haliplidae (1), Dytiscidae (16), Helophoridae (6), Hydrophilidae (8), Hydraenidae (5), Dryopidae (1), Elmidae (1) ed Heteroceridae (1). La maggior parte delle quali sono segnalate per la prima volta per le province di Valladolid (27 su 34) e Segovia (8 su 11). I risultati hanno rilevato una fauna relativamente povera, con una elevata percentuale di specie transiberiche e l'assenza di endemismi Iberici. Due segnalazioni sono notevoli dal punto di vista faunistico: *Hygrotus lagari* (Fery, 1992) e *Ochthebius meridionalis* Rey, 1885.

**Key words:** Water beetles, faunistics, Los Arenales, Valladolid, Segovia, Central Spain, wetlands.

## INTRODUCCIÓN

El conocimiento detallado de la distribución de los coleópteros acuáticos en la Península Ibérica es aún incompleto (Ribera, 2000) y ciertamente desigual. Aunque algunas comunidades autónomas (Aragón, Cataluña, Galicia, Islas Baleares, Murcia), provincias (Albacete, León) o áreas naturales (Cordillera Cantábrica, Doñana, Pirineos, Sierra Nevada, Sistema Ibérico) disponen de un grado de conocimiento alto o muy alto, la



coleopterofauna acuática de otras zonas geográficas peninsulares dista mucho de ser conocida con un mínimo de profundidad. Entre estas zonas escasamente prospectadas se encuentra la gran superficie central de la cuenca o depresión del Duero, en la submeseta Norte, que por la ausencia de zonas montañosas y una menor abundancia en medios acuáticos ha sido muy poco estudiada. Si en la zona de la Meseta situada al norte del Duero existen algunos trabajos circunscritos a humedales concretos de las provincias de Zamora (Régil & Garrido, 1993) y Palencia (Valladares et al., 1994; Valladares & Garrido, 2001), el conocimiento de los coleópteros acuáticos de la amplia zona de la Meseta situada al sur del Duero es prácticamente nulo.

#### ÁREA DE ESTUDIO

Los humedales estudiados se encuadran en el denominado complejo de descarga del acuífero de Los Arenales (fig. 1), situado al sur de la provincia de Valladolid, noroeste de la de Segovia y norte de Ávila (Comunidad Autónoma de Castilla y León). Se trata de un conjunto de humedales de diferentes tipologías que tienen su origen en el acuífero de Los Arenales que aporta las aguas subterráneas procedentes del Sistema Central en dirección Sur-Norte. El número de lagunas, charcas y lavajos en la zona es muy elevado: hay catalogados en el acuífero 130 humedales con necesidades de protección, de los que se han estudiado sus aspectos ecológicos y botánicos (Rey Benayas, 1991).



Fig. 1. Localización del área de estudio.



Los humedales muestreados son de pequeñas dimensiones (0,2-5,5 ha), carácter temporal y aguas alcalinas o hiperalcalinas. Los datos que se disponen a este respecto de la laguna del Bodón Blanco (Bocigas) señalan cifras de conductividad de 1.510  $\mu$ S/cm y 9.565 meq/l de alcalinidad total. La vegetación acuática característica de estas charcas incluye hidrófitos como *Chara canescens*, *Riella helicophylla* o *Tolypella salina* y helófitos como *Juncus maritimus*, *Plantago maritima*, *Scirpus holoschoenus* y *Scirpus maritimus*. De acuerdo a la clasificación de Rey Benayas (1991) se encuadran en el grupo de humedales del núcleo Olmedo-Coca, que constituyen la mejor expresión paisajística en la zona de los flujos intermedios de agua subterránea. Muchos de estos humedales tienen graves problemas de conservación a causa de la sobreexplotación del acuífero para riego y consumo humano. Uno de ellos, la laguna del Bodón Blanco, está incluida en el Catálogo de Zonas Húmedas de Castilla y León. La denominación y situación de las estaciones prospectadas y las fechas de los muestreos se reflejan en la Tab. 1.

Tab. 1. Estaciones de muestreo.

Humedal	Localidad	Provincia	U.T.M.	Fecha
Laguna de Aguasal-1	Aguasal	Valladolid (Va)	30TUL6169	29.V.1994
Laguna de Aguasal-2	Aguasal	Valladolid (Va)	30TUL6171	29.V.1994
Laguna de Almenara	Almenara de Adaja	Valladolid (Va)	30TUL5964	30.V.1994
Bodón Blanco	Bocigas	Valladolid (Va)	30TUL5965	30.V.1994
Laguna de Ciruelos	Ciruelos de Coca	Segovia (Sg)	30TUL6765	29.V.1994

METODOLOGÍA

Los ejemplares fueron recogidos mediante una manga pentagonal de entomología acuática de 250  $\mu$ m de luz de malla, con la que se realizaron mangueros en los márgenes y hacia el interior del medio acuático. Los coleópteros que flotan al remover el sustrato y la vegetación asociada a las orillas, especialmente de las familias de Polyphaga, se capturaron con un colador de malla fina. Mediante este procedimiento se prospectaron los diferentes hábitat, considerándose concluido el muestreo cuando aparentemente se habían recogido todas las especies presentes en la estación.

Se estudiaron un total de 307 ejemplares, todos adultos a excepción de una larva de *Dytiscus circumflexus* Fabricius, 1801. Este material se conserva en etanol al 70 % en la colección del primer autor.

RESULTADOS FAUNÍSTICOS

Se han identificado un total de 39 especies de Coleópteros acuáticos, repartidos entre las familias Haliplidae (1), Dytiscidae (16), Helophoridae (6), Hydrophilidae (8), Hydraenidae (5), Dryopidae (1), Elmidae (1) y Heteroceridae (1). La mayoría de estas especies son nuevas citas para las provincias de Valladolid y Segovia en que se sitúan los humedales estudiados.



Para cada especie se indica el tipo biogeográfico, siguiendo la propuesta de Ribera et al. (1998) modificada por Millán et al. (2002), concretando su distribución ibérica y la aportación faunística que supone el presente registro. Las distribuciones ibéricas de las especies se han obtenido, básicamente, de los trabajos de Montes & Soler (1986), Rico et al. (1990), Valladares & Montes (1991), Rico (1996), Aguilera et al. (1998) y Valladares & Ribera (1999). Con un asterisco (\*) se señalan las nuevas citas para la provincia de Valladolid y con un círculo negro (•) los nuevos registros para Segovia. Dichas provincias se abrevian Va y Sg en el apartado de material estudiado.

La ordenación de los taxones sigue el criterio utilizado para la Lista de coléopteros acuáticos ibéricos de Ribera et al. (1998).

#### HALIPLIDAE

*Haliphus (Neohaliphus) lineatocollis* (Marsham, 1802)

MATERIAL ESTUDIADO: Ciruelos de Coca (Sg), 1 ex.

Transibérica. Común en la Península Ibérica. Estaba citada en la zona montañosa de Segovia por Bertrand (1956).

#### DYTISCIDAE

*Laccophilus hyalinus testaceus* Aubé, 1837

MATERIAL ESTUDIADO: Ciruelos de Coca (Sg), 1 ex.

Transibérica. Muy frecuente en toda la Península Ibérica, incluida la Meseta Norte. Estaba citada en la montaña de Segovia por BERTRAND (1956).

\* • *Laccophilus minutus* (Linnaeus, 1758)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 3 ex.; Almenara de Adaja (Va), 4 ex.; Ciruelos de Coca (Sg), 12 ex.

Transibérica. Especie muy común y ampliamente citada en todo el territorio peninsular, incluidas las provincias cercanas al área de estudio, pero que no había sido en Segovia y Valladolid.

\* *Hyphydrus aubei* (Ganglbauer, 1892)

MATERIAL ESTUDIADO: Bocigas (Va), 2 ex.

Transibérica. Ampliamente citada en toda la Península, con registros en provincias cercanas como León, Palencia y Zamora.

\* *Yola bicarinata bicarinata* (Latreille, 1804)

MATERIAL ESTUDIADO: Almenara de Adaja (Va), 6 ex.

Transibérica. Especie ampliamente distribuida por todo el territorio peninsular, en la Meseta Norte se conoce en León y Palencia.



\* *Bidessus goudoti* (Castelnau, 1834)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Repartida por gran parte de la Península Ibérica, especialmente en el norte y oeste peninsular.

\* *Hydroglyphus geminus* (Fabricius, 1792)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 5 ex.

Transibérica. Especie muy común en toda la geografía peninsular, incluida la Meseta Norte, en cuyos humedales suele ser abundante (Valladares et al., 1994).

\* *Hygrotus (Coelambus) confluens* (Fabricius, 1787)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 12 ex.; Aguasal-2 (Va), 2 ex.; Almenara de Adaja (Va), 4 ex.

Transibérica. Con numerosas citas en toda la Península Ibérica. Estaba citada en la cuenca del Duero: León, Palencia y Zamora, en esta última, en las cercanas Lagunas de Villafáfila (Régil & Garrido, 1993).

• *Hygrotus (Coelambus) lagari* (Fery, 1992)

MATERIAL ESTUDIADO: Ciruelos de Coca (Sg), 2 ex.

Iberoafricana. Citada de forma dispersa por gran parte de la Península, a excepción de la zona situada al noreste del Ebro, en que es sustituida por *Hygrotus (Coelambus) parallelogramus* (Ahrens, 1812). Además de la cita de FERY (1992) en la provincia de León, que se corresponde a una localidad enclavada en la Cordillera Cantábrica, deben atribuirse a esta especie los registros de la Meseta Norte atribuidos a *Coelambus lernaesus* (Schaum, 1857) por Régil & Domínguez (1983) en Santas Martas (León) y posiblemente el dato de Fuente (1921) para Palencia.

El diseño de los élitros es un carácter con cierto grado de variabilidad. Los ejemplares estudiados muestran algunas diferencias en el diseño elitral (fig. 2) respecto al patrón conocido para esta especie, que había sido figurado (confundida con *Coelambus lernaesus* (Schaum, 1857)) por Régil & Domínguez (1983, fig. I.1) y Fresneda & Hernando (1989, fig. 1.b).

\* *Hydroporus planus* (Fabricius, 1781)

MATERIAL ESTUDIADO: Aguasal-2 (Va), 1 ex.; Almenara de Adaja (Va), 1 ex.

Transibérica. Presente en toda la Península Ibérica, más frecuente en la mitad norte.

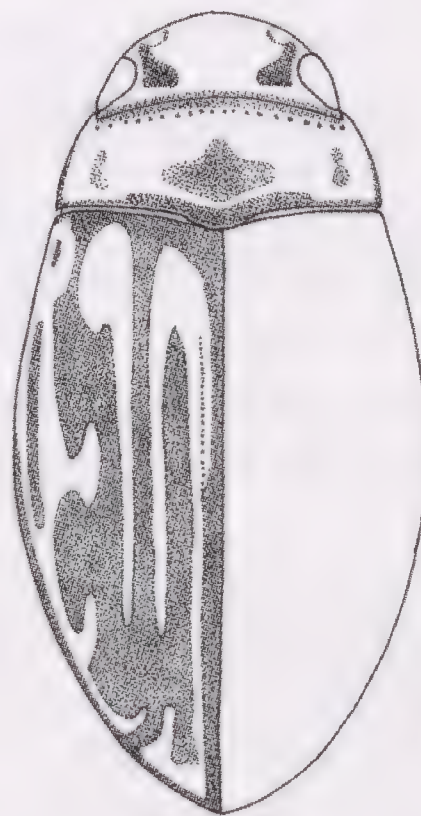


Fig. 2. Aspecto general y diseño elitral de *Hygrotus lagari* (Fery) (♂ de Ciruelos de Coca, Segovia). Escala: 0,5 mm.



\* *Graptodytes flavipes* (Olivier, 1795)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Ampliamente citada en toda la Península, sobre todo en las provincias de la mitad norte.

\* *Stictotarsus griseostriatus* (De Geer, 1774)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 1 ex.

Transibérica. Citada de forma dispersa en la Península Ibérica, la mayor parte de las citas se encuentran en las provincias más septentrionales. Existen serias dudas sobre la identidad de esta especie en la Península Ibérica (Ribera et al., 1998). Los datos moleculares más recientes indican que las poblaciones ibéricas que se vienen asignando a *S. griseostriatus* constituyen un complejo de especies de origen reciente (Ribera, 2003), cuyo estatus taxonómico está aún por resolver.

\* *Agabus (Gaurodytes) bipustulatus* (Linnaeus, 1767)

MATERIAL ESTUDIADO: Aguasal-2 (Va), 1 ex.; Almenara de Adaja (Va), 1 ex.

Transibérica. Especie muy común en toda la Península Ibérica, con citas en casi todas las provincias.

*Agabus (Gaurodytes) nebulosus* (Forster, 1771)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 4 ex.; Aguasal-2 (Va), 9 ex.; Almenara de Adaja (Va), 2 ex.; Bocigas (Va), 10 ex.; Ciruelos de Coca (Sg), 7 ex.

Transibérica. Presente en todo el territorio peninsular. Es una de las especies más abundantes en el área de estudio, cuya presencia ya era conocida en las dos provincias estudiadas: Segovia (Bertrand, 1956, 1957) y Valladolid (Fuente, 1921).

*Colymbetes fuscus* (Linnaeus, 1758)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Ampliamente distribuida por toda la Península Ibérica, con abundantes citas en la cuenca del Duero, incluida su presencia en la provincia de Valladolid (Régil et al., 1986).

*Dytiscus circumflexus* Fabricius, 1801

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex. (larva).

Transibérica. Presente en toda la Península Ibérica, con citas dispersas por la Meseta Norte, incluido un antiguo registro en la provincia de Valladolid (Fuente, 1921).

\* *Cybister (Scaphinectes) lateralimarginalis lateralimarginalis* (De Geer, 1774)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Especie con citas dispersas por todo el territorio peninsular, incluidas provincias cercanas al área de estudio.



HELOPHORIDAE

*Helophorus (Empleurus) rufipes* (Bosc d'Antic, 1791)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Repartida por toda la Península Ibérica, con excepción de la cornisa Cantábrica y Galicia. Se conocía de la depresión del Duero, incluida la provincia de Valladolid, de donde había sido citada por Angus (1984) a partir de uno de los tipos de *Helophorus pyrenaeus* Kuwert, 1885, sinónima de *H. rufipes*.

\* • *Helophorus (Trichelophorus) alternans* Gené, 1836

MATERIAL ESTUDIADO: Aguasal-1 (Va), 16 ex.; Aguasal-2 (Va), 8 ex.; Almenara de Adaja (Va), 4 ex.; Bocigas (Va), 16 ex.; Ciruelos de Coca (Sg), 4 ex.

Transibérica. Especie común y ampliamente repartida por el territorio peninsular, que sin embargo debe rarificarse en la región de Murcia donde Sánchez-Fernández et al. (2003, 2004) la consideran "vulnerable". En la zona de estudio es la especie más abundante, recogándose en todas las estaciones prospectadas.

Es de destacar la presencia de lo que parece un ejemplar teratológico de esta especie en la localidad de Aguasal-1 (in col. R. B. Angus, London). Se trata de un macho sin estría intercalar y palpos maxilares simétricos, que se encuadraría en el subgénero *Atrachelophorus* Kuwert, 1886 pero con flancos, estrías e interestrías de los élitros como las del subgénero *Trichelophorus* Kuwert, 1886. Su edeago es asignable a *Helophorus alternans*, pero con la pieza basal muy corta. Esta combinación de caracteres en un único ejemplar (los 15 restantes de la muestra exhiben los rasgos propios de *H. alternans*) nos hace inclinarnos más por un caso de individuo aberrante que por cualquier otra posibilidad de índole taxonómico.

*Helophorus (Helophorus) maritimus* Rey, 1885

MATERIAL ESTUDIADO: Aguasal-1 (Va), 11 ex.; Aguasal-2 (Va), 11 ex.; Almenara de Adaja (Va), 1 ex.

Iberoeuropea. Presente sobre todo en el centro y norte peninsular, es una especie frecuente en los humedales de la depresión del Duero. Su presencia en Valladolid ya había sido señalada por Angus (1983).

\* • *Helophorus (Atrachelophorus) brevipalpis* Bedel, 1881

MATERIAL ESTUDIADO: Aguasal-1 (Va), 8 ex.; Aguasal-2 (Va), 17 ex.; Almenara de Adaja (Va), 8 ex.; Bocigas (Va), 2 ex.; Ciruelos de Coca (Sg), 5 ex.

Iberoeuropea. Es una especie común y abundante por casi toda la Península, aunque parece rarificarse en algunas áreas como la región de Murcia (Sánchez-Fernández et al., 2004). Pese a su amplia distribución ibérica, no se había citado en las dos provincias del área de estudio donde es una especie muy frecuente.

\* *Helophorus (Rhopalhelophorus) longitarsis* Wollaston, 1864

MATERIAL ESTUDIADO: Aguasal-1 (Va), 1 ex.; Aguasal-2 (Va), 7 ex.; Almenara de Adaja (Va), 1 ex.

Transibérica. Especie con escasos registros peninsulares, circunscritos al Centro (incli-



da la provincia de Segovia) y Este de España, además de las islas Baleares (Valladares & Ribera, 1999).

*Helophorus (Rhopalhelophorus) asturiensis* Kuwert, 1885

MATERIAL ESTUDIADO: Aguasal-2 (Va), 4 ex.

Transibérica. Citada del Noreste, Sur y sobre todo en el Centro peninsular, en cuyos humedales de meseta debe ser una especie relativamente frecuente. Valladares & Ribera (1999), a partir de datos inéditos de este último, ya habían señalado su presencia en la provincia de Valladolid.

HYDROPHILIDAE

\* • *Berosus (Berosus) affinis* Brullé, 1835

MATERIAL ESTUDIADO: Aguasal-1 (Va), 12 ex.; Almenara de Adaja (Va), 3 ex.; Ciruelos de Coca (Sg), 7 ex.

Transiberica. Aunque no estaba registrada en ambas provincias, es una especie ampliamente distribuida por las zonas húmedas ibéricas.

\* *Berosus (Berosus) signaticollis* (Charpentier, 1825)

MATERIAL ESTUDIADO: Bocigas (Va), 4 ex.

Transibérica. Frecuente por todo el territorio peninsular.

\* *Anacaena bipustulata* (Marsham, 1802)

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Como en los dos casos anteriores, es una especie común cuya falta de citas es consecuencia de la inexistencia de muestreos.

\* *Helochares (Helochares) lividus* (Forster, 1771)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 6 ex.; Aguasal-2 (Va), 9 ex.; Almenara de Adaja (Va), 3 ex.; Bocigas (Va), 9 ex.

Transibérica. Sirve el comentario de la especie anterior, ya que probablemente es el más común de los hidrofílicos ibéricos.

\* *Enochrus (Lumetus) bicolor* (Fabricius, 1792)

MATERIAL ESTUDIADO: Aguasal-2 (Va), 1 ex.

Transibérica. Presente en toda la Península Ibérica, salvo la zona más septentrional. Es una especie indicadora de humedales con aguas fuertemente mineralizadas (Hansen, 1987).

\* *Enochrus (Lumetus) fuscipennis* (Thomson, 1884)

MATERIAL ESTUDIADO: Aguasal-2 (Va), 1 ex.

Transibérica. De amplia distribución peninsular, ya conocida de los humedales de la Meseta Norte.



\* *Hydrobius fuscipes* (Linnaeus, 1758)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 1 ex.; Aguasal-2 (Va), 3 ex.

Transibérica. Común en toda la Península, había sido citada en Segovia por Fuente (1925).

\* *Hydrochara flavipes* (Steven, 1808)

MATERIAL ESTUDIADO: Aguasal-2 (Va), 1 ex.; Bocigas (Va), 1 ex.

Transibérica. Citada por toda la geografía peninsular a excepción de Portugal, donde debe estar presente ya que se conoce de regiones limítrofes como Galicia (Garrido & Sáinz-Cantero, 2004) o Extremadura (Valladares & Ribera, 1999). Su presencia en Valladolid había sido recogida por Fuente (1925).

HYDRAENIDAE

\* *Ochthebius (Asiobates) minimus* (Fabricius, 1792)

MATERIAL ESTUDIADO: Almenara de Adaja (Va), 1 ex.

Iberoeuropea. Las citas ibéricas seguras de la especie se circunscriben al norte (Cantabria, Navarra) y centro peninsular (León, Palencia). Parece ligada a zonas de clima continental riguroso, ya que es especialmente abundante en humedales de la Meseta Norte (Valladares et al., 1994; Valladares & Garrido, 2001). Esta nueva cita para Valladolid representa el registro más meridional conocido de la especie en la Península Ibérica.

\* • *Ochthebius (Ochthebius) marinus* (Paykull, 1798)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 2 ex.; Bocigas (Va), 6 ex.; Ciruelos de Coca (Sg), 1 ex.

Transibérica. Especie ampliamente distribuida por el área mediterránea peninsular. En la Meseta Norte sólo se conocía de Palencia (Valladares et al., 1994; Valladares & Garrido, 2001).

\* *Ochthebius (Ochthebius) meridionalis* Rey, 1885

MATERIAL ESTUDIADO: Bocigas (Va), 1 ex.

Transibérica. Especie del área mediterránea, que contaba con citas en las provincias de Huesca y Zaragoza como únicos registros en el interior peninsular (Ribera et al., 1996) y, por tanto, era desconocida en la Meseta Norte. Su presencia en esta zona, relativamente norteña en el contexto peninsular, puede explicarse por las características de las charcas de la zona estudiada, medios someros de aguas mineralizadas, que son típicamente seleccionados por esta especie.

• *Ochthebius (Ochthebius) viridis* 2 sensu Jäch (1991)

MATERIAL ESTUDIADO: Ciruelos de Coca (Sg), 4 ex.

Transibérica. La forma 2 de *Ochthebius viridis* Peyron, 1858 es una especie diferente de la forma 1 (Jäch, 1991) de repartición típicamente mediterránea, que como la especie anterior está presente en humedales de las llanuras ibéricas: Valladares et al. (1994) y Valladares & Garrido (2001) la citan en Palencia y Ribera & Aguilera (1995) en Huesca.



• *Limnebius furcatus* Baudi, 1872

MATERIAL ESTUDIADO: Ciruelos de Coca (Sg), 1 ex.

Transibérica. Especie típica de charcas, que se reparte por toda la Península.

DRYOPIDAE

\* *Dryops luridus* (Erichson, 1847)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 1 ex.; Bocigas (Va), 3 ex.

Transibérica. Citada de distintas zonas de la Península Ibérica, incluida la Meseta Norte (Montes & Soler, 1986; Valladares & Garrido, 2001).

ELMIDAE

\* *Oulimnius rivularis* (Rosenhauer, 1856)

MATERIAL ESTUDIADO: Bocigas (Va), 2 ex.

Transibérica. Señalada sobre todo del oeste peninsular (Rico, 1996). Es una especie singular dentro de la familia Elmidae, ya que además de las aguas corrientes (con preferencia por enclaves temporales), vuelve a constatarse su presencia primaveral en medios estancados como las charcas de meseta (Valladares & Garrido, 2001).

HETEROCERIDAE

\* *Augyles (Littorimus) senescens* (Kiesenwetter, 1865)

MATERIAL ESTUDIADO: Aguasal-1 (Va), 1 ex.; Bocigas (Va), 1 ex.

Transibérica. Por toda la Península, si bien en la cuenca del Duero sólo se conocía del sur de Palencia (Aguilera et al., 1998; Valladares & Garrido, 2001).

COMENTARIO FINAL

Aunque se trata de un estudio preliminar, lo más destacable del presente trabajo es dar a conocer las líneas generales de la composición de la coleopterofauna acuática de una amplia zona geográfica carente de estudios a este respecto. En consecuencia, la mayoría de las especies identificadas son nuevas citas para las dos provincias del área de estudio y particularmente de Valladolid, que era una de las provincias españolas con menos registros de coleópteros acuáticos. La comunidad de coleópteros, aunque más pobre, coincide en gran medida con la observada en otros humedales someros de la Meseta Norte (Valladares et al., 1994; Valladares & Garrido, 2001; Valladares & Miguélez, 2004). Como principales novedades destacan las capturas en la zona de *Hygrotus lagari* y *Ochthebius meridionalis*, dos especies del ámbito mediterráneo que encuentran aquí un hábitat adecuado con charcas y lagunas someras ('shallow lakes') de aguas fuertemente mineralizadas.

Los valores de riqueza obtenidos en el acuífero de Los Arenales, aunque aún incompletos, son relativamente bajos. La riqueza total de 39 especies es bastante inferior a la de otras áreas estudiadas en la Meseta Norte: 50 en la laguna de La Nava (Valladares et al., 1994), 51 en la turbera fósil de Espinosa de Cerrato (Valladares & Miguélez,



2004) y 92 en los humedales asociados al Canal de Castilla (Valladares & Garrido, 2001). También es bastante más reducido el número de especies recolectadas en cada estación: el rango de riqueza en Los Arenales es de 11-19 especies (14 de media) en cada humedal, frente a una variación de entre 22-43 especies (33 de media) en la zona del Canal de Castilla. Pese al posible defecto de muestreo, la baja diversidad observada podría estar relacionada con la importante mineralización del agua de las charcas estudiadas que puede restringir la supervivencia de determinadas especies. Otra posible razón añadida es la sobreexplotación del acuífero y la agricultura intensiva de la zona, con aportación de altos niveles de contaminantes a las charcas.

El análisis de la composición biogeográfica de la fauna estudiada muestra también un alto grado de simplificación (fig. 3). Tan solo aparecen tres tipos biogeográficos, con una gran predominio de los elementos de amplia distribución, transibéricos (87 %) e iberoeuropeos (10 %) y una presencia muy reducida de los de distribución restringida (3 % de elementos iberoafricanos, representados únicamente por *Hygrotus lagari*). Destaca también la ausencia de elementos endémicos, ya que aunque su representación es muy baja en medios estancados, en humedales próximos (Valladares et al., 1994; Valladares & Garrido, 2001; Valladares & Miguélez, 2004) siempre se ha localizado un pequeño porcentaje de especies endémicas (2-4 %). Es posible que un muestreo más intenso de la zona pueda aportar la presencia de algún endemismo ibérico, ya que los medios de aguas salobres con fuerte temporalidad son enclaves propicios para estas especies (Ribera, 2000).

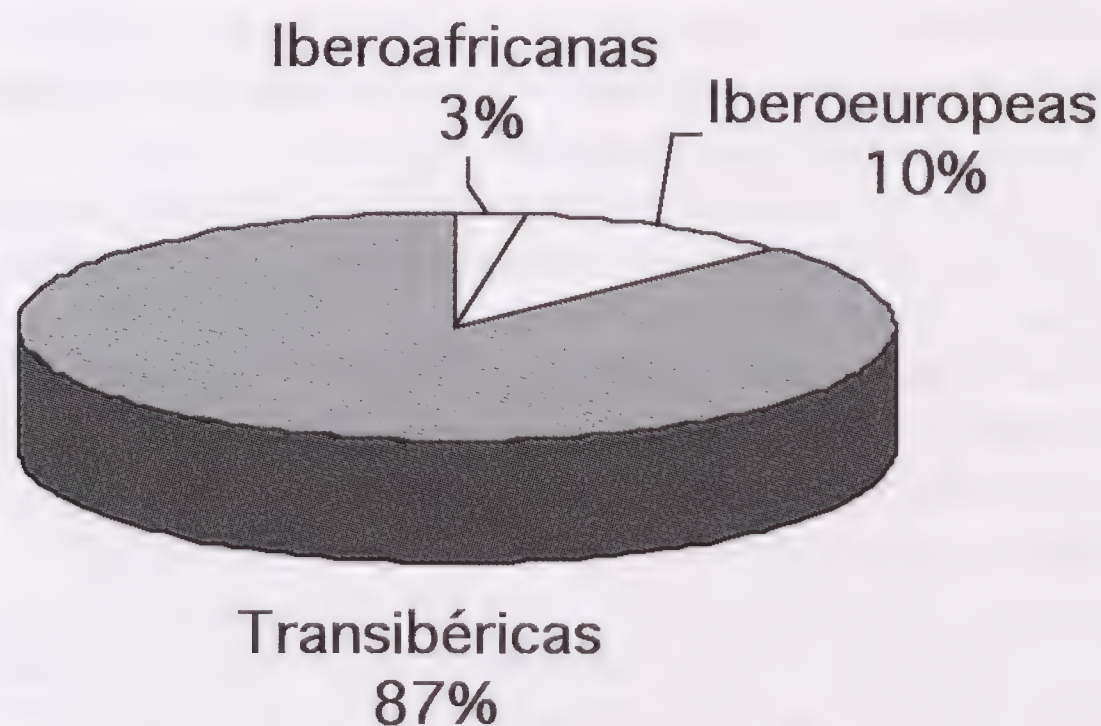


Fig. 3. Composición biogeográfica de la coleopterofauna estudiada.

#### AGRADECIMIENTOS

Deseamos expresar nuestra gratitud al Dr Baudilio Herrero (Universidad de Valladolid, Palencia) por su colaboración en los muestreos con el primer autor en la primavera de 1994. Gracias también al Dr Robert B. Angus (University of London) y al Dr Manfred A. Jäch (Naturhistorisches Museum, Viena) por su ayuda en la identificación de algunas especies y al Dr Ignacio Ribera (Museo Nacional de Ciencias Naturales, Madrid) por sus aclaraciones.



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Joseph E. POWELL & Robert B. ANGUS

## A chromosomal investigation of some European species of Haliplidae (Coleoptera)

**Abstract** - The karyotypes of 15 European species of Haliplidae are described and illustrated. The sex chromosomes are X0 in *Brychius elevatus* and *Peltodytes caesus*, and XY in 13 species of *Haliphus*. The number of autosome pairs is 16 in *Peltodytes caesus*, 19 in *Brychius elevatus*, 17 in *Haliphus* (*Liaphlus*) *fulvus*, 15 in *H. (L.) variegatus*, 14 in *H. (L.) flavicollis*, 11 in *H. (L.) laminatus*, 9 in *H. (L.) mucronatus*, and 11 in *H. (Haliplidius) obliquus* and *H. (H.) confinis*, *H. (Neohaliphus) lineatocollis* and five species of *H. (Haliphus)*. It is suggested that the X0 sex chromosome system, the most common in the Adephaga, is plesiotypic for Haliplidae, and that the XY systems are a synapomorphy of the family, and are neo-XY in origin. There is no good evidence of Xy<sub>p</sub> systems of the type found in Polyphaga.

The diversity of karyotypes shown by species of the subgenus *Liaphlus* is contrasted with the near uniformity shown by other groups. Interspecific differences between karyotypes are noted.

**Riassunto** - Studio dei cromosomi di alcune specie europee di Haliplidae (Coleoptera).

Sono descritti e illustrati i cariotipi di 15 specie europee di Haliplidae. I cromosomi sessuali sono X0 in due specie (*Brychius elevatus* e *Peltodytes caesus*) e XY in 13 specie di *Haliphus*. Il numero di coppie di autosomi è 16 in *Peltodytes caesus*, 19 in *Brychius elevatus*, 17 in *Haliphus* (*Liaphlus*) *fulvus*, 15 in *H. (L.) variegatus*, 14 in *H. (L.) flavicollis*, 11 in *H. (L.) laminatus*, 9 in *H. (L.) mucronatus*, e 11 in *H. (Haliplidius) obliquus*, *H. (H.) confinis*, *H. (Neohaliphus) lineatocollis* e in cinque specie di *H. (Haliphus)*. Si suggerisce che il sistema cromosomico sessuale X0, il più comune negli Adephaga, è plesiotipico per gli Haliplidae, e che i sistemi XY sono una sinapomorfia della famiglia, e sono neo-XY in origine. Non ci sono buone prove di sistemi Xy<sub>p</sub> del tipo riscontrato nei Polyphaga. La diversità dei cariotipi osservata nelle specie del sottogenere *Liaphlus* contrasta con la quasi uniformità di altri gruppi. Sono state osservate differenze interspecifiche tra i cariotipi.

**Key words:** Chromosomes, karyotypes, sex-chromosomes, Haliplidae.

### INTRODUCTION

The Coleoptera, with more than 370000 species (McGavin, 2001), are generally regarded as the largest order of insects. Chromosomal investigations of Coleoptera have been undertaken since the work of Stevens (1905) on the sex chromosomes of Chrysomelidae. Beetle cytotaxonomy as a whole was reviewed by Smith & Virkki (1978), where the karyotypes of 2160 species are listed. One of the unexpected features of this work was the suggestion by Smith (1950) that there appeared to be a basic coleopteran karyotype (chromosome formula) comprising 9 pairs of autosomes plus sex chromosomes which were XX in the female and "Xy<sub>p</sub>" in the male. The Xy<sub>p</sub> arrangement consists of a large X chromosome and a very small Y chromosome, which, at first division of meiosis, are held together by a cytoplasmic vesicle. John & Lewis (1960) regarded this vesicle as a nucleolus, but modern fluorescence in situ hybridisation techniques have demonstrated that in some cases no r-DNA (characteristic of nucleoli and their organisers) is present (Juan et al., 1993).



Smith (1950) based his conclusions on a database of only 191 species, representing 66 families. In the event, his hypothesis has stood up well in the suborder Polyphaga (Smith & Virkki, 1978), but there is as yet no convincing evidence for  $Xy_p$  sex chromosomes in the other main coleopteran suborder, the Adephaga. Thus Serrano & Yadav (1984) did not list  $Xy_p$  among 426 species of Adephaga (mainly Carabidae), and Serrano & Galián (1998) did not list it among over 900 species of Carabidae.

The chromosomes of the aquatic families of Adephaga (Hydradephaga) are much less well known than those of the Carabidae. Thus Smith & Virkki (1978) list only 27 species, belonging to the families Dytiscidae and Gyrinidae, none with  $Xy_p$ . Recent works (Nilsson & Angus, 1992; Nilsson, 2000; Angus, unpublished data) demonstrate XO systems (lacking Y chromosomes in the male, typical of Carabidae) and neo-XY systems, but never  $Xy_p$ . Hughes & Angus (1999) demonstrated an Xy system in *Hygrobia hermanni* (Fabricius, 1775) (Hygrobiiidae), but with an apparently chiasmate association at meiosis. In Noteridae both neo-XY systems and systems involving multiple X chromosomes have been reported (Bilton, 1992; Ahmed et al. 1997; Ahmed & Angus, 2000). Of the major adephagan families, only the Haliplidae remain completely unreported chromosomally.

The Haliplidae have a worldwide distribution and probably include about 220 species (van Vondel, 1997). They are highly unusual among Adephaga in being vegetarian (algophagous) as both adults and larvae, though according to van Vondel (1997) the adults also take animal food. The other unique feature of the family is the large coxal plates on the hind legs. These plates were present in the Triassic (fossil) family Triaplidae (Ponomarenko, 1977), and their occurrence suggests that the Haliplidae have had a long period of evolution separate from other adephagan families. Preliminary observations (unpublished) by R. B. Angus indicated that at least *Haliphus ruficollis* (DeGeer, 1774) has a small Y chromosome, raising the possibility that the Haliplidae might have an  $Xy_p$  system at meiosis, perhaps retained from an ancestral coleopteran arrangement.

In view of this background, the objectives of this investigation are threefold:

1. To give some account of the karyotypes of Haliplidae.
2. To establish whether there is an  $Xy_p$  system in this family, and if there is such a system, whether it is likely to be plesiomorphic.
3. To see to what extent similar and apparently related species have clearly different karyotypes.

## MATERIAL

Species from which chromosome preparations have been obtained, along with the localities where they were collected, are listed in Table 1. British localities are referred to their Watsonian Vice-Counties, as reviewed by Dandy (1969). Vice-Counties from which material was collected are as follows: England: 11, South Hants; 17, Surrey; 21, Middlesex; 24, Buckinghamshire; 28, West Norfolk. Scotland: 76, Renfrew; 92, South Aberdeen.

The species are classified according to van Vondel (1997) and Lundmark et al. (2001), but, for chromosomal reasons, species of *Haliphus* (*Liaphlus*) are listed before those of the other subgenera.



Table 1. Species used for chromosome analysis.

Species	Location
<i>Brychius elevatus</i> (Panzer, 1793)	England. V.C 11, River Test at Romsey and Kimbridge
<i>Peltodytes caesus</i> (Duftschmid, 1805)	Netherlands. Haarlem district, duneslack pools at Bloemendaal. England. V.C. 17, Runnymede, Langham Pond.
<i>Haliplus (Liaphlus) fulvus</i> (Fabricius, 1801)	Scotland. V.C. 92, Loch Kinord.
<i>H. (L.) variegatus</i> Sturm, 1834	England. V.C. 11, New Forest, Crockford Bridge.
<i>H. (L.) flavicollis</i> Sturm, 1834	England. V.C. 28, Thompson Common. Scotland. V.C. 76, Loch Libo
<i>H. (L.) laminatus</i> (Schaller, 1783)	England. V.C. 21, River Colne, Staines Moor
<i>H. (L.) mucronatus</i> Stephens, 1828	Netherlands. Haarlem district, duneslack pools at Bloemendaal.
<i>H. (Haliplidius) obliquus</i> (Fabricius, 1787)	England. V.C. 17, Runnymede, Langham Pond; V.C. 21, Staines Moor; V.C. 28, Thompson Common.
<i>H. (H.) confinis</i> Stephens, 1828	England. V.C. 21, Staines Moor; V.C. 28, Thompson Common.
<i>H. (Neohalipus) lineatocollis</i> (Marsham, 1802)	England. V.C. 28, Wolferton
<i>H. (Halipus) ruficollis</i> (DeGeer, 1774)	England. V.C. 11, New Forest, Hatchet Pond; V.C. 21, Staines Moor; V.C. 28, Thompson Common.
<i>H. (H.) sibiricus</i> Motschulsky, 1860 (= <i>wehnckei</i> Gerhardt, 1877)	England. V.C. 28, Wolferton.
<i>H. (H.) fluviatilis</i> Aubé, 1836	England. V.C. 21, R. Colne, Staines Moor; V.C. 28, Wolferton.
<i>H. (H.) lineolatus</i> Mannerheim, 1844	England. V.C. 17, Virginia Water Lake; V.C. 21, R. Colne, Staines Moor; V.C. 24, Wraysbury Gravel Pit
<i>H. (H.) immaculatus</i> Gerhardt, 1877	England. V.C. 21, Staines Moor; V.C. 24, Wraysbury Gravel Pit

METHODS

The procedures presented here are based on those developed by Angus (1982), and Shaarawi & Angus (1991). Chromosome preparations were obtained from mid gut, testis and ovary. Treatment with colchicine and hypotonic potassium chloride was for 12 seconds in each case. Relative Chromosomes Lengths (RCL – the length of each chromosome as a percentage of the total haploid autosome length in the nucleus) have not been calculated in this study. This is because the material is in general a small number of preparations from a fairly large number of species. Statistical analysis of RCL values would therefore not be possible, and comparisons using absolute lengths in individual preparations were considered to be sufficiently informative. The specimens from which chromosome preparations were obtained are kept in R. B. Angus’ collection.

RESULTS

*Brychius elevatus* (Panzer, 1793). Material analysed: 3 specimens. 2N = 38 + X0 (♂), XX (♀). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 c and d. First metaphase of meiosis, showing the unpaired X chromosome, is shown in fig. 3 a. The chromosomes are all small, with the longest autosomes only about 2.5 mm long, while the X chromosome, and the smaller autosomes are about 1 µm long. The longer autosomes include both metacentrics and acrocentrics. C-banding (fig. 1 d) shows small centromeric C-bands on most of the chromosomes. The individual chromatids are not visible in the preparations obtained from this species.



*Peltodytes caesus* (Duftschmid, 1805). Material analysed: 4 specimens.  $2N = 32 + X0$  ( $\sigma^7$ ),  $XX$  ( $\phi$ ). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 a and b. Autosome pairs 1 – 13, 16, and the X chromosome are either acrocentric or subacrocentric, and C-banding (fig. 1 b) shows that the long arms of autosomes 1 – 13 are almost entirely heterochromatic, and metacentric autosomes 14 and 15 have large heterochromatic C-bands over the centromere. Only autosome 16 and the X chromosome are entirely euchromatic. The chromosomes are fairly large, with autosomes 1 – 10 about  $4\ \mu\text{m}$  long, while autosomes 14 and 15, and the X chromosome, are about  $2\ \mu\text{m}$  long. Comparison of the karyotypes of *P. caesus* and *B. elevatus* suggests that, despite the different sizes of their chromosomes, the total length of euchromatic chromosome regions is similar in the two species.

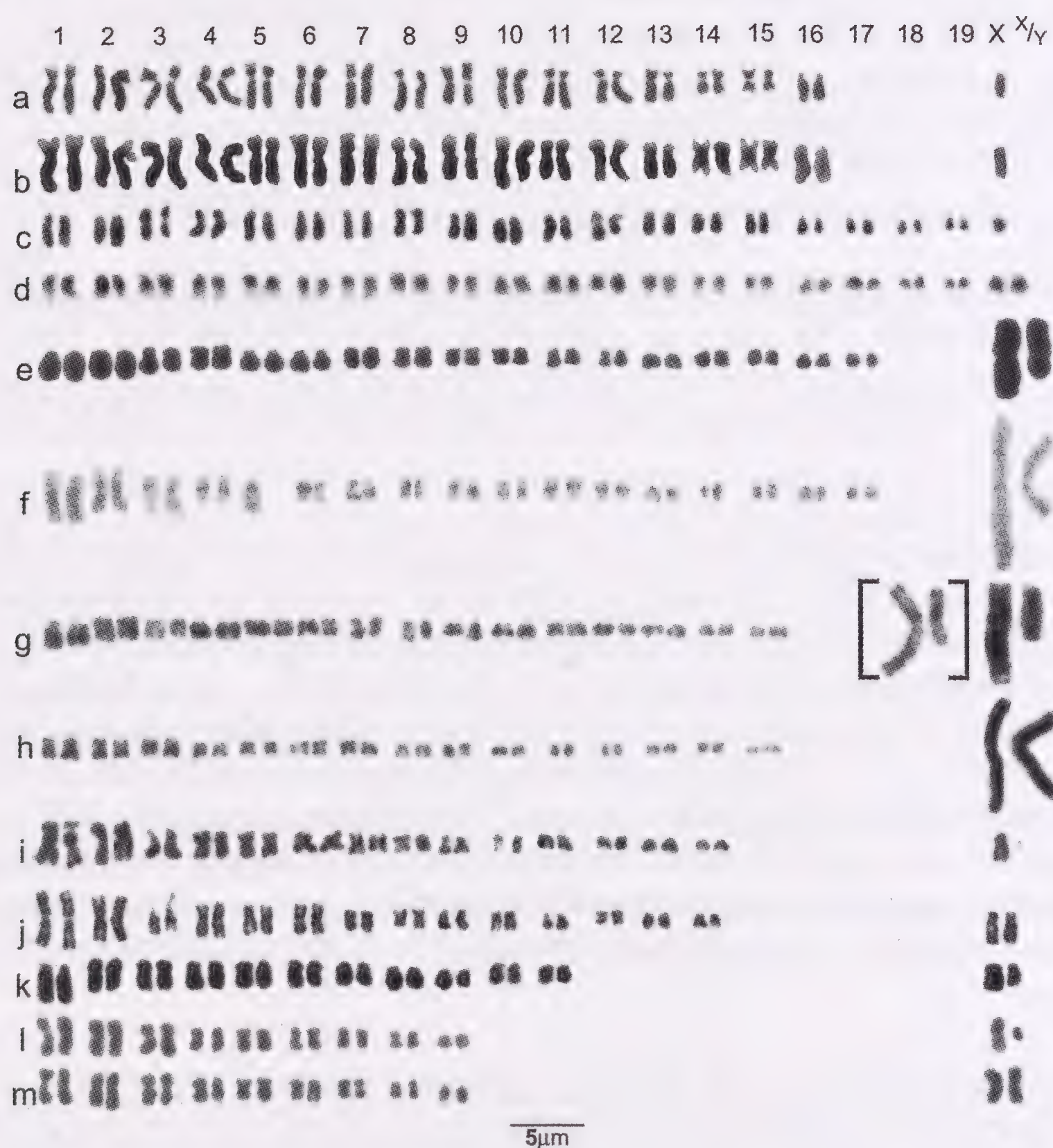


Fig. 1 a-m. Mitotic chromosomes arranged as karyotypes: a - *Peltodytes caesus*,  $\sigma^7$ , mid gut, Bloemendaal, plain; b: the same nucleus, C-banded; c, d - *Brychius elevatus*, River Test, c  $\sigma^7$ , testis, plain, d  $\phi$ , ovary, C-banded; e, f - *Haliphus fulvus*,  $\sigma^7$ , testis, Loch Kinord, e plain, f C-banded; g - *H. variegatus*,  $\sigma^7$ , mid gut, Crockford Bridge, sex chromosomes from a second, incomplete nucleus shown in brackets []; h - *H. variegatus*,  $\phi$ , ovary, Crockford Bridge; i - *H. flavicollis*,  $\sigma^7$  mid gut, Loch Libo; j - *H. flavicollis*,  $\phi$ , mid gut, Thompson Common; k - *H. laminatus*,  $\sigma^7$ , testis, Staines Moor; l - *H. mucronatus*,  $\sigma^7$ , mid gut, Bloemendaal; m - *H. mucronatus*,  $\phi$ , mid gut, Bloemendaal.





Fig. 2 a-r. Mitotic chromosomes arranged as karyotypes: a - *Haliphus obliquus*, ♂, testis, Thompson Common; b - *H. obliquus*, ♂, mid gut, Staines Moor; c - *H. obliquus*, ♀, mid gut, Thompson Common; d, e - *H. confinis*, ♀, mid gut, Thompson Common, d plain, e C-banded; f - *H. lineatocollis*, ♂, testis, Wolferton; g - *H. ruficollis*, ♂, mid gut, Staines Moor; h - *H. ruficollis*, ♂, testis, Pevensey, C-banded; i - *H. ruficollis*, ♀, mid gut, Thompson Common; j, k - *H. sibiricus*, ♂, testis, Wolferton, j plain, k C-banded; l, m - *H. fluviatilis*, ♂, mid gut, Wolferton, l plain, m C-banded; n, o - *H. lineolatus*, ♂, mid gut, Wraysbury, n plain, o C-banded; p, q - *H. immaculatus*, ♂, mid gut, Wraysbury, p plain, q C-banded; r: *H. immaculatus*, ♀, mid gut, Virginia Water.

*Haliphus* (*Liaphlus*) *fulvus* (Fabricius, 1801). Material analysed: 2 specimens.  $2N = 34 + XY$  (♂). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 e and f. No meiotic preparations were obtained. The autosomes are small, with the longest being approximately  $2 \mu\text{m}$  long. The smallest autosomes are about  $1 \mu\text{m}$  long. In comparison the X and Y chromosomes are very large, about 7 and  $5 \mu\text{m}$  long in fig. 1e. Although only males were obtained the X and Y chromosomes were identified by comparison with those



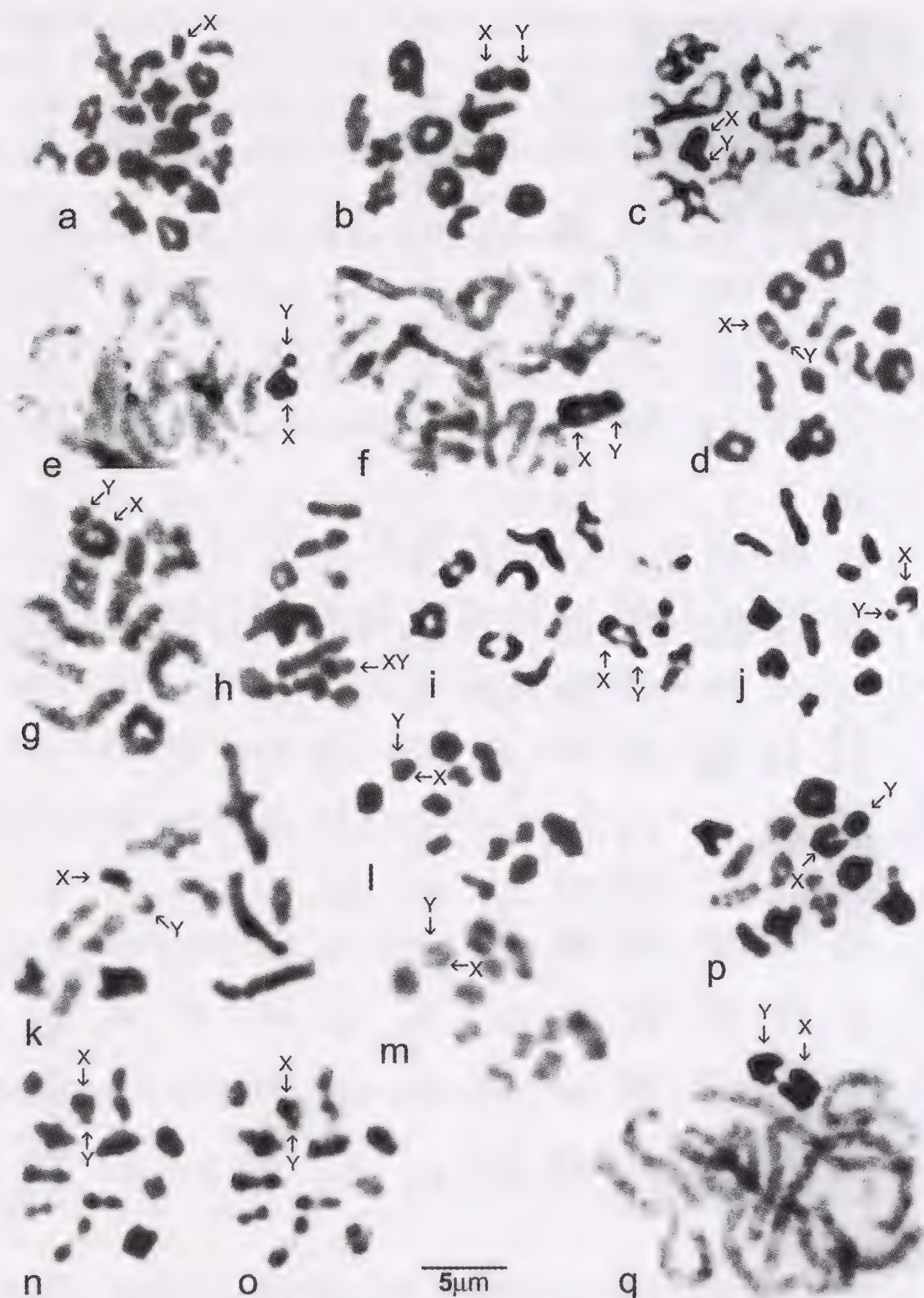


Fig. 3 a-q. First division of meiosis from testis. The X and Y chromosomes are labelled: a - *Brychius elevatus*, R. Test, metaphase; b - *Haliphus laminatus*, Staines Moor, metaphase; c, d - *H. obliquus*, Thomson Common, c diakinesis, d metaphase; e-h - *H. ruficollis*, e, f, h, Thomson Common, g Hatch-et Pond. e, f, early and late zygotene, g diakinesis, h metaphase; i, j - *H. sibiricus*, Wolferton, i diakinesis, j metaphase; k-m - *H. fluviatilis*, Wolferton, k diakinesis, l, m metaphase, the same nucleus, l plain, m after C-banding treatment; n-o - *H. lineolatus*, Wraysbury, metaphase, the same nucleus, n plain, o after C-banding treatment; p, q: *H. immaculatus*, Wraysbury, p late diakinesis, q zygotene.

of *H. variegatus* (fig. 1 g and h). The autosomes include both metacentrics and acrocentrics. The individual chromatids are not visible in the testis preparations obtained from this species. C-banding (fig. 1 f) shows small centromeric C-bands on all the chromosomes, with a larger C-banding area, possibly a secondary constriction, on autosome 1. This is a very striking karyotype because of the extreme size of the sex chromosomes compared with



the autosomes. The X chromosome is equal in length to between a quarter and over a third of the total haploid autosome length in the nucleus, depending on the degree of contraction of the preparation. One by-product of this is that incomplete karyotypes, lacking some autosomes, may look intact. However, the close agreement between the arrangements shown in fig. 1 e and f, differing only in the loss of one replicate of autosome 5 in fig. 1 f, suggests that this is the correct karyotype.

*Haliplus (Liaphlus) variegatus* Sturm, 1834. Material analysed: 3 specimens.  $2N = 30 + XY$  (♂),  $XX$  (♀). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 g and h. Additional sex chromosomes from an incomplete nucleus are shown in brackets [ ]. No preparation of meiosis was obtained as the testes of the material (collected in November) contained only mature sperm. The autosomes are small, the longest being about  $2\text{ }\mu\text{m}$  long, and the smallest about  $1\text{ }\mu\text{m}$  long. Again, in comparison the sex chromosomes are very large, approximately  $5 - 8\text{ }\mu\text{m}$  long. The majority of the autosomes are metacentrics, although some are acrocentrics, the sex chromosomes are metacentric. Individual chromatids are visible on a few chromosomes. Fig. 1 h shows a karyotype of a female *H. variegatus*. In this midgut preparation the individual chromatids are visible in the majority of the autosomes.

*Haliplus (Liaphlus) flavicollis* Sturm, 1834. Material analysed: 2 specimens.  $2N = 28 + Xy$  (♂),  $XX$  (♀). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 i and j. The sex chromosomes are a medium sized acrocentric X chromosome, about  $2\text{ }\mu\text{m}$  long, and a dot-like y chromosome. The autosomes range from medium length to small, the longest being about  $5\text{ }\mu\text{m}$  long, while the smallest about  $0.5\text{ }\mu\text{m}$  long. They include both metacentrics and acrocentrics.

*Haliplus (Liaphlus) laminatus* (Schaller, 1783). Material analysed: 1 specimen.  $2N = 22 + XY$  (♂). Mitotic chromosomes, arranged as a karyotype, are shown in fig. 1 k. First metaphase of meiosis, showing paired XY chromosomes, is shown in fig. 3 b. The chromosomes are rather similar in size, with the largest autosomes being about  $3.5\text{ }\mu\text{m}$  long, while the smaller autosomes and sex chromosomes being approximately  $2\text{ }\mu\text{m}$  long. The X chromosome is in the middle of the size range of the autosomes, while the Y is slightly shorter. The autosomes include both metacentrics and acrocentrics. The individual chromatids are not visible in the testis preparations obtained from this species.

*Haliplus (Liaphlus) mucronatus* Stephens, 1828. Material analysed: 3 specimens.  $2N = 18 + Xy$  (♂),  $XX$  (♀). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 1 l and m. The autosomes are small, about  $2.5 - 0.8\text{ }\mu\text{m}$  long, while the sex chromosomes are a relatively large X chromosome, about  $2.5\text{ }\mu\text{m}$  long and a very small y chromosome, about  $0.5\text{ }\mu\text{m}$  long. All the chromosomes are metacentric, except autosome 9 and the y chromosome, which are acrocentric. C-banding (not shown) appears very weakly developed, with small indistinct centromeric C-bands on some of the autosomes.



*Haliphus (Haliplidius) obliquus* (Fabricius, 1787). Material analysed: 5 specimens.  $2N = 22 + Xy$  ( $\sigma^7$ ),  $XX$  ( $\varphi$ ). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 2 a-c. First metaphase of meiosis, showing paired  $Xy$  chromosomes, is shown in fig. 3 c and d. Diakinesis is shown in fig. 3 c and first metaphase of meiosis is shown in fig. 3 d. The condensed  $Xy$  bivalent is labelled, and the arrangement, especially in fig. 3 d, looks a little like  $Xy_p$ . The size range of the chromosomes range is such that the longest chromosomes are about three times the length of the shortest, the largest autosome in the preparations shown here being about  $3\ \mu\text{m}$  long and the smallest approximately  $1\ \mu\text{m}$  long. The  $X$  chromosome is about  $3\ \mu\text{m}$  long, while the  $y$  is dot-like. The autosomes include both metacentrics and acrocentrics. The individual chromatids are visible in preparations shown in fig. 2 b and c, though not in fig. 2 a.

*Haliphus (Haliplidius) confinis* Stephens, 1828. Material analysed: 2 specimens.  $2N = 22 + XX$  ( $\varphi$ ). Mitotic chromosomes, arranged as karyotypes, are shown in fig. 2 d and e. fig. 2 e shows a C-banded karyotype for this species. There is heavy banding on the suggested  $X$  chromosomes. The sex chromosomes cannot be identified from the material studied, as only females were available for analysis. The suggested  $X$  chromosome in fig. 2 d and e is based on comparison with *H. obliquus*. The longest autosomes are approximately  $4\ \mu\text{m}$  long and the smallest about  $2\ \mu\text{m}$  long. C-banding (fig. 2 e) shows secondary constrictions on the long arms of autosome 2 and the suggested  $X$ -chromosome. In the  $X$  there is some indication of variation in the expansion of this constriction between the two replicates of the chromosome, giving an apparent size and centromere position difference. The chromosomes include both metacentrics and acrocentrics.

*Haliphus (Neohaliphus) lineatocollis* (Marsham, 1802). Material analysed: 1 specimen.  $2N = 22 + Xy$  ( $\sigma^7$ ). Mitotic chromosomes, arranged as a karyotype, are shown in fig. 2 f. No meiotic preparation was obtained. The majority of the autosomes are long, being approximately  $4.5\ \mu\text{m}$  long for the largest, and  $3\ \mu\text{m}$  long for the smallest. The  $X$  chromosome is a similar length, although the  $y$  is very small, about  $1\ \mu\text{m}$  long. The autosomes include both metacentrics and acrocentrics. The individual chromatids are not visible in the preparations for this species.

*Haliphus (Haliphus) ruficollis* (DeGeer, 1774). Material analysed: 10 specimens.  $2N = 22 + Xy$  ( $\sigma^7$ ),  $XX$  ( $\varphi$ ). Mitotic chromosomes from the mid gut and testis of males, arranged as karyotypes, are shown in fig. 2 g and h. respectively. Mitotic chromosomes from female mid gut, arranged as a karyotype, are shown in fig. 2 i. C-banding (fig. 2 h) shows autosome 1 with a secondary constriction in its long arm, and this tends to be expanded to a different extent in the two replicates. This gave great difficulty in arranging karyotypes from unbanded material (fig. 2 g and i) until the cause of the very different sizes of the two replicates of autosome 1 was understood. The largest autosomes are approximately  $4.5\ \mu\text{m}$  long, and the smallest about  $1\ \mu\text{m}$  long. The  $X$  chromosomes are of similar length to the larger autosomes, although the  $y$  is considerably smaller being about  $1.5\ \mu\text{m}$  long. The autosomes include both metacentrics and acrocentrics. Individual chromatids are visible for some of the chromosomes, particularly in preparations for the mid-gut. fig. 3 e-h



all show meiotic preparations. Fig. 3 e and f shows the chromosomes in early and late zygotene, with the heavily condensed X and y chromosomes lying together. Fig. 3 g shows the chromosomes in late diakinesis, with the X chromosome looped almost in a complete circle, with apparent links to the y from both its ends. Fig. 3 h shows paired X and y chromosomes in metaphase, giving a much more condensed appearance which could be interpreted as  $Xy_p$ , but not unequivocally so.

*Haliplus (Haliplus) sibiricus* Motschulsky, 1860. Material analysed: 1 specimen  $2N = 22 + Xy$  ( $\sigma^7$ ). Mitotic chromosomes from the testis, arranged as a karyotype, are shown in fig. 2 j and k. C-banding (fig. 2 k) shows heavy banding on the y chromosome and autosomes 1 and 5. The longest autosomes are approximately  $5 \mu\text{m}$  long, while the smallest are about  $1.5 \mu\text{m}$  long. The X chromosome is about the same size as the largest autosomes and the y chromosome is very small, almost dot like. There is a secondary constriction in the short arm of the 8<sup>th</sup> pair of autosomes, and this can be either extended or condensed. The autosomes include both metacentrics and acrocentrics. The individual chromatids are clearly visible in the unbanded karyotype (fig. 2 j), though not so in the C-banded preparation. Meiotic preparations are shown in fig. 3 i and j. The Xy bivalent at first metaphase could be interpreted as  $Xy_p$  (fig. 3 j), but diakinesis (fig. 3 i) shows two apparently terminalised chiasmata linking the sex chromosomes.

*Haliplus (Haliplus) fluviatilis* Aubé, 1836. Material analysed: 4 specimens.  $2N = 22 + Xy$  ( $\sigma^7$ ). Mitotic chromosomes from the mid-gut, arranged as a karyotype, are shown in fig. 2 l and m. C-banding (fig. 2 m) shows heavy banding on the long arms of autosomes 1 and at the centromeres of most of the acrocentric autosomes. The first pair of autosomes are clearly the largest, being approximately  $4 \mu\text{m}$  long, the remaining autosomes are considerably smaller, with the smallest about  $0.5 \mu\text{m}$  long. Both of the sex chromosomes are about the same size, although small, approximately  $1 \mu\text{m}$  long. Individual chromatids are visible in the unbanded preparation from the mid-gut. Although the karyotype includes both metacentric and acrocentric autosomes, the vast majority of them are acrocentric, possibly with the exception of the first pair. Meiotic preparations are shown in fig. 3 k-m, with diakinesis shown in fig. 3 k and first metaphase in fig. 3 l and m. These two figures are of the same nucleus, plain in l and C-banded in m. Diakinesis (fig. 3 k) suggests terminalised chiasmata in the Xy bivalent (as in *H. sibiricus*, fig. 3 i), while the condensed sex bivalent at metaphase could be interpreted as  $Xy_p$ , though not convincingly so.

*Haliplus (Haliplus) lineolatus* Mannerheim, 1844. Material analysed: 4 specimens.  $2N = 22 + Xy$  ( $\sigma^7$ ). Mitotic chromosomes from the mid-gut, arranged as karyotypes, are shown in fig. 2 n and o. C-banding (fig. 2 o) shows heavy regions of banding in most of the autosomes. On metacentric autosomes banding is seen at the centromeres of pairs 4, 5 and 8, and on the short arms of pairs 1-3. Banding is also seen at the centromeres of most of the remaining acrocentric autosomes. The largest autosomes are approximately  $3.5 \mu\text{m}$  long while the smallest are about  $1 \mu\text{m}$  long. The X chromosome is about  $2 \mu\text{m}$  long and the y chromosome is very small and dot-like. Individual chromatids are clearly visible for the unbanded mid-gut preparation (fig. 2 n) The karyotype includes both metacentric and



acrocentric autosomes. Meiotic preparations are shown in fig. 3 n and o. Both figures show metaphase of the same nucleus, showing paired X and y chromosomes, with fig. 3 n being plain and fig. 3 o showing the preparation after C-banding treatment. The sex bivalent appears to show terminalised chiasmata, especially after C-banding treatment, despite the very small size of the y chromosome.

*Haliphus (Haliphus) immaculatus* Gerhardt, 1877. Material analysed: 6 specimens.  $2N = 22 Xy (\sigma^7)$ ,  $XX (\varphi)$ . Mitotic chromosomes from the mid-gut, arranged as karyotypes, are shown, from a male in fig. 2 p and q and from a female in fig. 2 r. C-banding (fig. 2 q) shows banding on all of the chromosomes. On metacentric autosomes banding is seen at the centromeres of pairs 3-6, 9, 10, and on the short arms of pairs 1 and 2. Banding is also seen at the centromeres of all of the remaining acrocentric autosomes and at the centromere of the metacentric X chromosome. There is a pericentric inversion polymorphism in the longest autosome (autosome 1), which may be either acrocentric (the centromere more or less terminal) or submetacentric (the centromere near, but clearly not in, the middle of the chromosome). Fig. 2 p and q shows a male heterozygous for this polymorphism, while fig. 2 r shows a female with homozygous acrocentric autosome 1. The largest autosomes are approximately  $5 \mu\text{m}$  long in fig. 2 r, and the smallest autosomes are about  $1 \mu\text{m}$  long in this figure. The X chromosomes are the largest in the nucleus, approximately  $6 \mu\text{m}$  long in fig. 2 r. The y chromosomes are small, about a third as long as the X. The individual chromatids are clearly visible in the female preparation from the mid-gut, though less so in the male preparations. The karyotype includes both metacentrics and acrocentrics. Meiotic preparations are shown in fig. 3 p and q. Heavy condensation of the chromosomes in late diakinesis is shown in fig 3 p and the clearly visible, heavily condensed sex chromosomes at zygotene are shown in fig. 3 q. The orientation of the arms of the sex chromosomes in this figure strongly suggests terminalised chiasmata.

## DISCUSSION

The results presented here show both a considerable diversity in the karyotypes of Haliplidae, and also a large and apparently diverse assemblage of species with broadly similar karyotypes. The karyotype of *Brychius elevatus*, with 19 pairs of autosomes and an X0 sex chromosome system, is very similar to that recorded by Serrano & Yadav (1984) and Serrano & Galián (1998) (18 pairs of autosomes plus X0) as the commonest karyotype for Carabidae. Beutel & Ruhna (1990) in their cladistic analysis of Haliplidae, place *Brychius* as the second most basal group to separate from the main stem of the family, which suggests that this karyotype, especially as regards its X0 sex chromosomes, may be plesiomorphic within the Haliplidae. The most basal separation recorded by Beutel & Ruhna is that of *Peltodytes* Régimbart, 1879. The karyotype of *P. caesus* appears highly aberrant in the very extensive development of heterochromatin, but it does support the idea that X0 sex chromosomes are the original arrangement in the Haliplidae.

Within the genus *Haliphus* Latreille, 1802 the most striking result is the numerically uniform karyotype (11 pairs of autosomes plus Xy sex chromosomes), shown by members of the subgenera *Haliphus* s. str., *Haliplidius* Guignot, 1928 and *Neohaliphus* Netolitzky, 1911, as well



as *H. (Liaphlus) laminatus*. The systematic position of *H. laminatus* has long been questioned, with debate as to whether it belongs in *Liaphlus* Guignot, 1928 or nearer to *Haliplus* s. str. (van Vondel, 1997). The karyotype of 11 pairs of autosomes plus Xy sex chromosomes in *H. laminatus* at first appeared to support its placement near *Haliplus* s. str. However, the subsequent discovery of a diverse selection of karyotypes within *Liaphlus*, both with regard to number and the size of the sex chromosomes, leaves the whole matter once more unclear.

The nature of the XY system of sex chromosomes in Haliplidae may be considered both in terms of whether it is primitive (plesiomorphic) or derived (apomorphic), in terms of whether an  $Xy_p$  system is present where the Y chromosome is conspicuously small (Xy). If the X0 systems of *Brychius* and *Peltodytes* are indeed plesiomorphic, the XY system of other Haliplidae, whatever its nature, is apomorphic. The usual way in which XY systems are recorded as emerging from X0 systems is by fusion of the X chromosome with an autosome to give a neo-XY system (Smith & Virkki, 1978). In this system, the original autosome, without the X chromosome, becomes the neo-Y chromosome, while the autosome plus original X becomes neo-X. The association of the neo-XY bivalent at meiosis is by chiasmata between their original autosomal portions. The apparently terminalised chiasmata shown by at least some of the XY bivalents at first division of meiosis (especially *H. sibiricus* at diakinesis, fig. 3 i) suggests that this is indeed a neo-XY system. Although a number of more condensed metaphase preparations (e.g. *H. obliquus*, fig. 3 d, *H. ruficollis*, fig. 3 h and *H. fluviatilis*, fig. 2 l and m) could be interpreted as showing  $Xy_p$ , none is unequivocal, and in particular, none shows any sign of a cytoplasmic vesicle. The terminalised chiasmata suggested by preparations of diakinesis seem a more likely explanation. C-banding suggests that the smaller Y chromosome may be almost entirely heterochromatic (*H. ruficollis*, fig. 2 h) or euchromatic with small heterochromatic bands at the centromere (*H. lineolatus*, fig. 2 o). There is also considerable variation in the size of the X chromosome – the largest in the nucleus in *H. immaculatus* (fig. 2, p-r), but among the smallest in *H. fluviatilis* (fig. 2, l and m).

The karyotypes of the species in this “karyotype-group” show interspecific differences in terms of the relative lengths and centromere positions of various chromosomes. Although many small *Haliplus* species may appear similar and difficult to identify (especially as females), none of the species studied here approaches sibling or doubtful status. *Haliplus ruficollis* and *H. sibiricus* (= *wehnckei*) have sometimes been considered as a pair (e.g. Balfour-Browne, 1940), though their aedeagophores are clearly very different. As to their karyotypes, autosome 3 is acrocentric in *H. ruficollis* but submetacentric in *H. sibiricus*, while autosomes 7 and 8 are submetacentric in *H. ruficollis* but acrocentric in *H. sibiricus*. *Haliplus sibiricus* and *H. wehnckei* used to be separated on the form of the right paramere, and Holmen (1987) notes that they have been regarded as possible subspecies but may in fact be conspecific – a view now confirmed by enzyme electrophoresis and morphometric analysis (Lundmark et al., 2001). The British material reported here is of the *H. wehnckei* pattern, and it would be interesting to know the karyotype of specimens with the *H. sibiricus* type of right paramere. It is interesting that there are no obvious differences between the karyotypes of *H. confinis* and *H. obliquus* – easily recognisable species but in the same subgenus (*Haliplidius*). It should be noted that no male karyotype of *H. confinis* has been obtained.



The karyotypes of the *Liaphlus* species studied here are a surprisingly heterogeneous assemblage, especially after the uniformity shown by the other *Halipilus* species. *Halipilus fulvus* and *H. variegatus* have very similar, long sex chromosomes. Their size suggests that they are neo-X and neo-Y. It is notable that *H. fulvus* has 17 pairs of autosomes, as against 15 in *H. variegatus*. The karyotypes of *H. flavicollis*, *H. laminatus* and *H. mucronatus* are all different from one another. *Halipilus flavicollis* has 14 pairs of autosomes, one pair fewer than *H. variegatus*, and three pairs more than *H. laminatus* and the other subgenera, while *H. mucronatus*, with only nine pairs of autosomes, has the lowest chromosome number so far encountered in the Haliplidae. Beutel & Ruhnau (1990) suggest that they have no evidence of monophyly of *Liaphlus*, and the chromosome data presented here support this view. One other conclusion proposed by Beutel & Ruhnau (1990), that *Neohalipilus* may be the first group to branch off within the “*Algophilus-Apteralipilus-Halipilus* complex”, is not supported by the chromosome data. Beutel & Ruhnau (1990) suggest that *Algophilus* Zimmermann, 1924 is part of a monophyletic unit including Ethiopian species of *Liaphlus* (not studied here!), but unless these species are karyotypically similar to *H. laminatus* and the other subgenera, it is very unlikely that *Neohalipilus* (*H. lineatocollis*) would have branched off before them. Clearly, there is scope for further chromosomal investigations here.

#### ACKNOWLEDGEMENTS

This study is based on a final-year undergraduate project undertaken by J. E. Powell, supervised by R. B. Angus. We thank the School of Biological Sciences, Royal Holloway, for the facilities to carry out the research. We also thank Drs G. N. Foster and D. T. Bilton, and members of the Balfour-Browne Club who took part in the 2004 meeting in the Netherlands, for material of *Peltodytes caesus*, *Halipilus mucronatus* and *H. fulvus*.

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Mario TOLEDO

## Considerazioni preliminari sui cicli vitali e strategie riproduttive di alcune specie di Dytiscidae nella pianura padana (Coleoptera)

**Riassunto** - Le osservazioni effettuate su 25 specie provenienti da 12 località della pianura padana, hanno permesso di tracciare un primo, provvisorio, profilo della biologia riproduttiva e dei cicli vitali delle comunità di Dytiscidae in questo territorio. L'esame dei cicli vitali è stato effettuato utilizzando le categorie bionomiche di Nilsson (1986a) per il nord Europa, comparandone le definizioni con le situazioni riscontrate in pianura padana, dove finora tre tipi di cicli vitali sono stati riscontrati: i cicli numero 1), 4) e 5) sensu Nilsson (1986a). Il primo ciclo alle nostre latitudini si è rivelato più complesso che in Europa settentrionale; infatti esso può essere a sua volta suddiviso in 2 categorie: 1a) specie univoltine che si riproducono in un periodo limitato della bella stagione; 1b) specie univoltine, ma forse anche bi o plurivoltine che si riproducono continuamente o in più periodi della bella stagione. È infatti probabile che alcune specie che in nord Europa sono univoltine, alle nostre latitudini siano bivoltine o plurivoltine; ciononostante non esistono ancora prove che sia in effetti così. La presenza di due specie di *Ilybius* del gruppo *chalconatus* in pianura padana, pur non essendo ancora state studiate biologicamente, fa presumere che anche il ciclo n. 3) possa essere rappresentato in questo territorio. Rispetto al nord Europa, in una comunità della pianura padana le larve compaiono in anticipo o in ritardo, a seconda che si tratti di riproduttori primaverili o autunnali e gli stadi preimmaginali in media sono più brevi rispetto allo stadio adulto; questo in relazione anche al periodo riproduttivo in generale più lungo alle nostre latitudini. Infine, sono discussi brevemente il concetto di core-species in una comunità a Dytiscidae e le diverse preferenze ambientali in relazione alla riproduzione.

**Abstract** - Preliminary data on life cycles and breeding strategies of some species of Dytiscidae in the Po plain (northern Italy) (Coleoptera).

Observations on 25 species, from 12 localities in the Po Plain in Northern Italy, provide a first, provisional, idea of the life cycles and breeding strategies of communities of Dytiscidae in this territory. The study is based on a comparison with Nilsson's (1986a) bionomic categories for Northern Europe, and three types of life cycles have so far been observed in the Po Plain: life cycles numbers 1), 4) and 5) sensu Nilsson (1986a). The first type is more complex than in Northern Europe as it can be divided into two categories: 1a) univoltine species with a brief reproductive period; 1b) univoltine, but maybe bivoltine or even plurivoltine, species, with an extended reproductive period during spring, summer and autumn. It is in fact probable that some species which are univoltine in Northern Europe are bivoltine or plurivoltine in Italy; nevertheless this has yet to be proved. The presence of two species of *Ilybius* belonging to the *chalconatus*-group in the Po Plain, even if not yet studied, suggests at least the possibility that life cycle n. 3) also exists in this locality. Compared to Northern Europe, in a Po Plain community larvae occur either earlier or later, depending on, respectively, spring or autumn breeding, and the immature stages are on average shorter than the adult stage, a fact which is also related to the longer breeding season in general. The concept of core-species and the habitat preferences related to reproduction are briefly discussed.

**Key words:** Dytiscidae, northern Italy, life cycles, breeding strategies.



## INTRODUZIONE

In Italia settentrionale come nel resto dell'Europa, tutte le specie di Dytiscidae hanno larve acquatiche, predatrici, che vanno incontro a tre mute, per poi lasciare l'acqua ed impuparsi in una celletta nel terreno, nel muschio, tra detriti vegetali, ecc. Gli adulti sono acquatici, per lo più buoni volatori e guadagnano facilmente altri corpi d'acqua per disperdersi dagli ambienti natali o per raggiungere altri siti più adatti allo sviluppo delle future larve. Conoscenze più approfondite sulla biologia riproduttiva di questi insetti, però, si possono considerare ancora alquanto lacunose, nel nostro Paese come in buona parte dell'Europa. Ciononostante importanti contributi in materia hanno interessato principalmente la Fennoscandia, dove, a tutt'oggi, sono state riconosciute e definite cinque categorie distinte di cicli vitali (Nilsson, 1986a, 1987, 1989; Nilsson & Holmen, 1995):

- 1) Specie univoltine che si riproducono in primavera, con larve in estate e che svernano come adulti.
- 2) Specie univoltine che si riproducono tra estate ed autunno e che svernano come uova.
- 3) Specie semivoltine che si riproducono in primavera e che svernano come uova il primo inverno e come adulti il secondo inverno.
- 4) Specie semivoltine che si riproducono in estate e passano il primo inverno come larve ed il secondo inverno come adulti.
- 5) Specie con periodo riproduttivo flessibile, che svernano sia come larve che adulti.

La prima categoria sarebbe la più diffusa, interessando tutte le specie di Copelatinae, Laccophilinae, e Dytiscinae viventi in nord Europa, più varie specie di altre sottofamiglie (Nilsson & Holmen, 1995). Diverse specie di Dytiscidae presenti alle latitudini settentrionali del Vecchio Continente, hanno distribuzione ampia e arrivano anche molto più a sud in Europa: questo può comportare differenze clinali tra popolazioni diverse, con variazioni di parametri quali anche il voltinismo (Nilsson, 1986a). Ciononostante, finora, veramente pochi sono i contributi in grado di mettere in luce queste differenze e poche volte sono state utilizzate le sopraelencate categorie bionomiche (es. Dettner et al., 1986; Carr, 1989). Una letteratura piuttosto esigua (es. Galewsky, 1964, 1985) che ha fornito però alcune notizie sulla biologia riproduttiva di diverse specie di Dytiscidae, permette di dedurre che questi cicli vitali valgono in sostanza anche per l'Europa centrale, sebbene con differenze che interesserebbero più che altro i periodi di sviluppo larvale e la complessità dei cicli stessi; per lo meno del ciclo di tipo 1). Per l'Italia Nardi & Maltzeff (2001) forniscono dati sul rinvenimento di larve e adulti di alcune specie di Hydradeephaga in provincia di Roma, ipotizzando almeno due generazioni l'anno per alcune di esse. Qualche altra notizia sull'aspetto riproduttivo e fenologico di alcune specie di Dytiscidae nel nostro Paese, esiste anche grazie ai lavori sulla morfologia larvale di De Marzo (1973, 1974, 1976a, 1976b). Ciononostante si tratta di dati necessariamente frammentari, per quanto utili, scarsamente utilizzabili da soli per una trattazione organica sull'argomento. Grazie alla mole di dati, raccolti principalmente in occasione di importanti progetti che hanno interessato alcune zone umide della Lombardia, la presente comunicazione vorrebbe dare un primo, incompleto, contributo alla conoscenza dei cicli vitali e strategie riproduttive dei Dytiscidae italiani, basandosi sulla comparazione delle categorie bionomiche presentate da Nilsson (1986a), con la situazione riscontrata finora in pianura padana.



AREA DI STUDIO

Il materiale studiato è stato raccolto principalmente in due Riserve Naturali gestite dal WWF, ed in una gestita dal Parco Oglio Sud, tutte e tre ubicate nella pianura lombarda; rispettivamente: Riserva Naturale di Monticchie (Somaglia, LO), Riserva Naturale di Le Bine (Acquanegra sull'Oglio, MN) e Torbiere di Marcaria (MN), presso le quali sono stati svolti il maggior numero di rilievi. La prima Riserva (fig. 6) è costituita da un complesso di canali alimentati da risorgive, caratterizzati dall'essere relativamente stabili (ad eccezione del momentaneo prosciugamento di buona parte di essi durante il 1999), con acque debolmente correnti - ferme in alcuni punti - generalmente ben ossigenate, con abbondante vegetazione acquatica e ombreggiati da una copertura arborea prevalentemente a alneto-saliceto dalla quale ricevono un abbondante apporto organico (Toledo, 2000). Le altre due, invece, sono grandi aree paludose presso le quali sono stati effettuati campionamenti sia in corpi d'acqua stagnante con ricca vegetazione a idrofite e detrito organico (figg. 3, 5), sia anche, presso Le Bine, in stagni con fondo limoso e spoglio (fig. 4). Per un approfondimento sugli ambienti si consiglia di consultare Mazzoldi (1987), Toledo (2000, 2003) e Agapito Ludovici & Cecere (2003). Le prime due località sono state indagate durante il 1996, 1997, 1999, 2000 e, per Le Bine, anche 2003 e 2004. Marcaria è stata oggetto di campionamenti recenti nel 2000, 2002 e 2003. In tutte e tre le Riserve i rilievi sono stati eseguiti con una frequenza media di una volta al mese.

Materiale aggiuntivo inoltre, proveniente da altre località della pianura padana e raccolto in diverse occasioni, è stato utilizzato in aiuto alle osservazioni effettuate nelle Riserve; nella tab. 1 sono elencate anche queste località e gli anni di raccolta.

Tab. 1. Località di ricerca e anni di investigazione.

Numero	Comune (Provincia)	località	Anni di investigazione
1	Acquanegra sull'Oglio (Mantova)	Riserva Naturale di Le Bine	1996, 1999, 2000, 2003, 2004
2	Somaglia (Lodi)	Riserva Naturale di Monticchie	1997, 1999, 2000
3	Marcaria (Mantova)	Torbiere di Marcaria	1985, 1986, 1987, 2000, 2003
4	Besnate (Varese)	Parco dei Fontanili	2000
5	Ostiglia (Mantova)	Palude del Busatello	1999
6	Rodigo (Mantova)	Fossati presso Rodigo	1987, 1988
7	Mantova	Laghi di Mantova	1987, 1988
8	Manerba del Garda (Brescia)	Fossati presso Manerba del Garda	1987
9	Orzinuovi (Brescia)	Lanca del F. Oglio presso Orzinuovi	1985
10	Trenzano (Brescia)	Fontanile di Trenzano	1982
11	Malalbergo (Bologna)	L'Ercolana	1995, 1996, 1997 (Bosi, 1998)
12	Torricella del Pizzo (Cremona)	Lanca del Po di Torricella del Pizzo	1989

MATERIALI E METODI

I campionamenti sono stati effettuati con i metodi normalmente usati in entomologia per indagini di questo tipo: un robusto retino per insetti acquatici, insieme ad una serie di colini a maglie fini, sono gli strumenti principalmente utilizzati per la raccolta del materiale. Gli esemplari adulti rinvenuti sono stati in parte uccisi in fiale con etile acetato



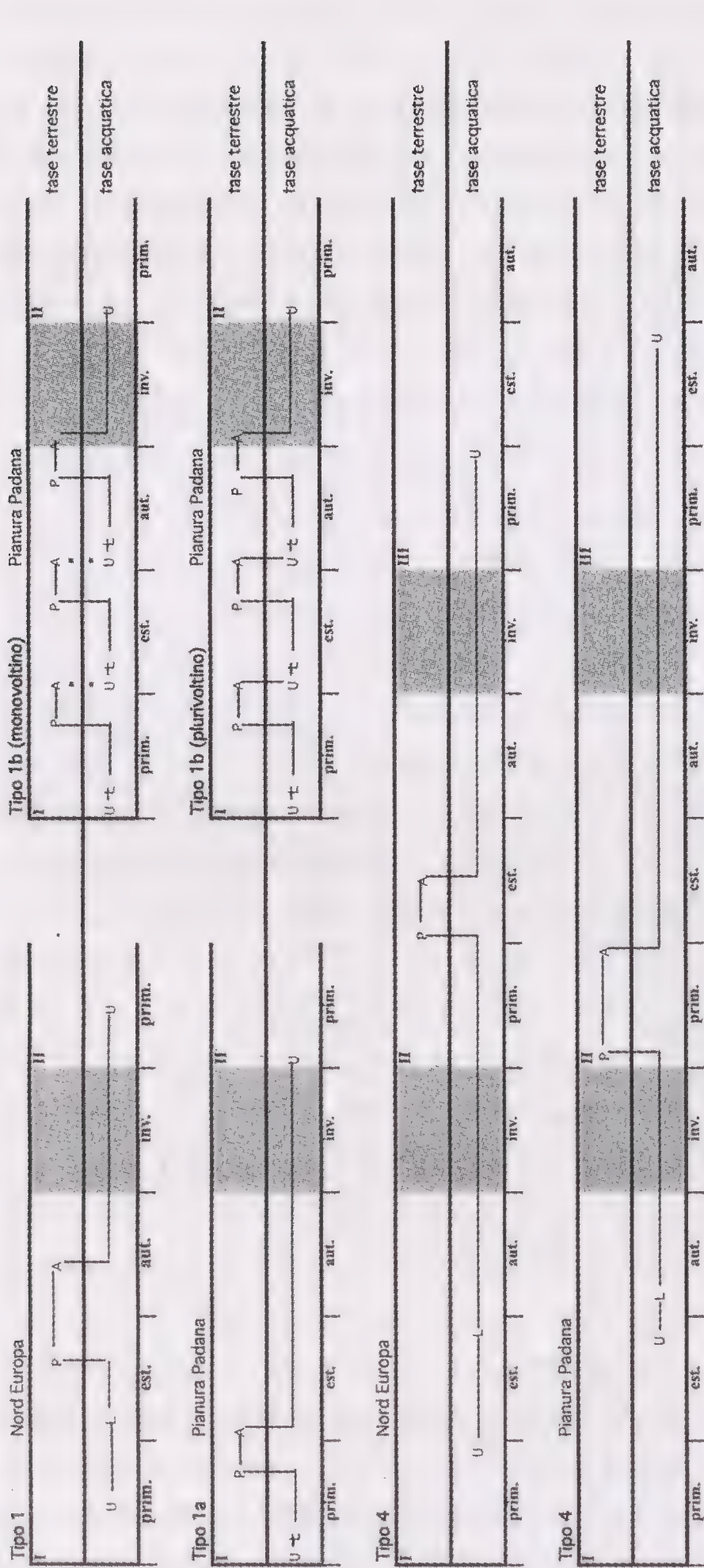


Fig. 1. Schema dei cicli vitali ri-scontrati in pianura padana, comparati con i loro equivalenti per il nord Europa. Le linee seguono il passaggio dall'uovo (U) alla larva (L), pupa (P) e adulto (A) in relazione alla stagione e all'anno (in numero romano in alto a sinistra) e lo stadio in cui avviene lo svernamento. Viene indicata anche la fase acquatica e terrestre dell'individuo.

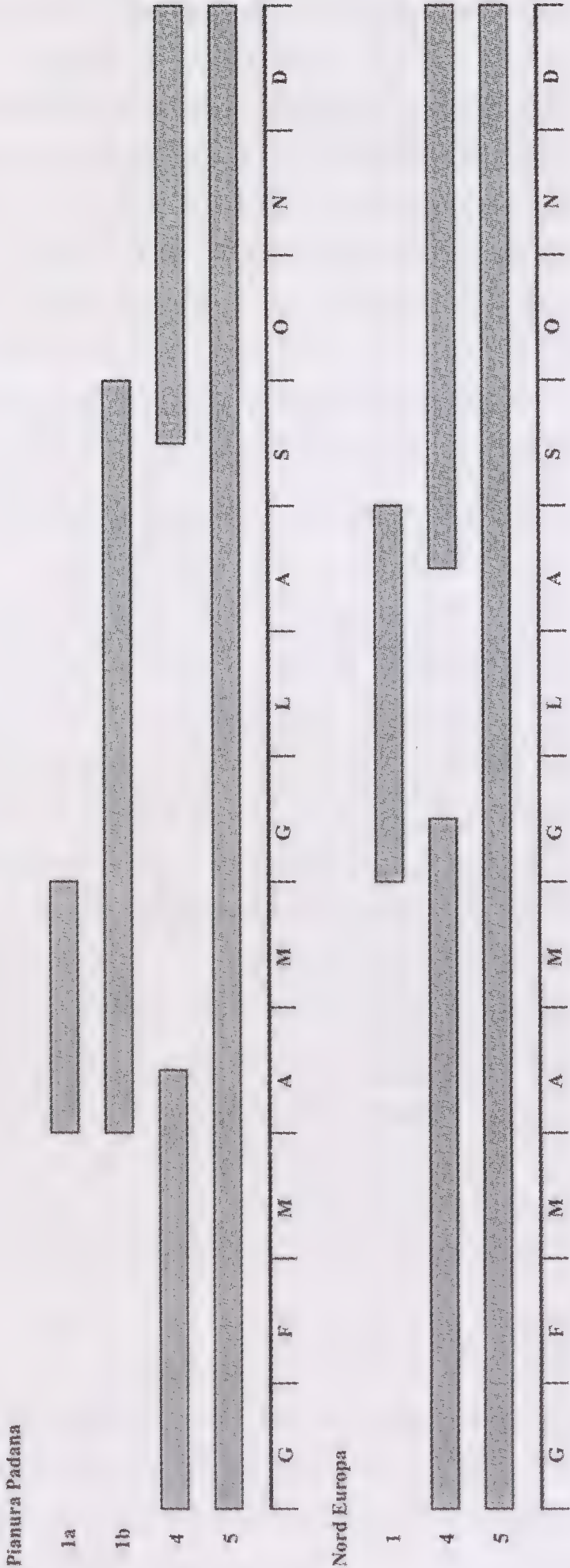


Fig. 2. Periodo annuo (medio) di sviluppo larvale riscontrato in pianura padana, a confronto con il nord Europa (Nilsson, 1986a). I numeri della colonna a sinistra indicano il tipo di ciclo vitale, le lettere in basso i mesi.





Fig. 3. Riserva Naturale di Le Bine: vista della lanca (foto P. Mazzoldi).



Fig. 4. Riserva Naturale di Le Bine: stagno scavato nel 1995. Ambiente di riproduzione di *Hydaticus grammicus*, insieme a *Rhantus suturalis* e *Laccophilus minutus* (foto M. Toledo).



per essere studiati in laboratorio ed in parte sono stati rilasciati sul posto, dopo aver registrato su un taccuino specie e numero di esemplari oltre che, quando possibile, grado di sclerificazione e di pigmentazione dei tegumenti. Particolare attenzione è stata prestata agli stadi preimmaginali durante i campionamenti, con l'ausilio di una bacinella nella quale "lavare" a poco a poco il detrito pescato col retino o con i colini. Le larve, poi, afferrate delicatamente con una pinzetta morbida, venivano fissate in etanolo a 75%, dentro tubi di polipropilene.

L'esame del materiale raccolto con trappole luminose (fig. 7), impiegate presso le riserve di Le Bine e Monticchie per diversi studi entomologici, ha permesso, inoltre, di ottenere notizie sulla dispersione in volo di alcune specie di Dytiscidae in queste località.

Nel corso della primavera del 1999, infine, sono stati allestiti degli allevamenti, grazie ai quali è stato possibile ottenere larve ex ovo di alcune specie e seguirne lo sviluppo, secondo le metodologie di Alarie et al. (1989).

Vista l'importanza delle larve per la determinazione dei comportamenti riproduttivi, la scelta delle specie qui trattate è stata fatta in base alla reperibilità dei rispettivi stadi preimmaginali durante le raccolte. Sono state studiate le seguenti specie di Dytiscidae:

- 1 - *Hyphydrus ovatus* (Linné, 1761)
- 2 - *Hygrotus (Hygrotus) inaequalis* (Fabricius, 1777)
- 3 - *Hygrotus (Coelambus) impressopunctatus* (Schaller, 1783)
- 4 - *Hydroporus palustris* (Linné, 1761)
- 5 - *Hydroporus angustatus* Sturm, 1835
- 6 - *Liopterus haemorroidalis* (Fabricius, 1787)
- 7 - *Agabus (Agabus) undulatus* (Schrank, 1776)
- 8 - *Agabus (Gaurodytes) didymus* (Olivier, 1795)
- 9 - *Agabus (Gaurodytes) bipustulatus* (Linné, 1767)
- 10 - *Ilybius ater* (De Geer, 1774)
- 11 - *Ilybius quadriguttatus* (Boisduval & Lacordaire, 1835)
- 12 - *Ilybius fuliginosus fuliginosus* (Fabricius, 1792)
- 13 - *Ilybius subaeneus* Erichson, 1837
- 14 - *Rhantus (Nartus) grapii* (Gyllenhal, 1808)
- 15 - *Rhantus (Rhantus) suturalis* (Mac Leay, 1825)
- 16 - *Colymbetes fuscus* (Linné, 1758)
- 17 - *Hydaticus (Hydaticus) seminiger* (De Geer, 1774)
- 18 - *Hydaticus (Hydaticus) transversalis transversalis* (Pontoppidan, 1736)
- 19 - *Hydaticus (Guignotites) grammicus* (Germar, 1830)
- 20 - *Graphoderus cinereus* (Linné, 1758)
- 21 - *Acilius (Acilius) sulcatus* (Linné, 1758)
- 22 - *Dytiscus marginalis marginalis* Linné, 1758
- 23 - *Cybister (Scaphinectes) lateramarginalis lateramarginalis* (De Geer, 1774)
- 24 - *Laccophilus minutus* (Linné, 1758)
- 25 - *Laccophilus poecilus* Klug, 1834

Per la determinazione delle larve raccolte sul campo sono stati utilizzati i lavori di De Marzo (1973, 1974, 1976a, 1976b), Dettner (1982, 1984), Galewski (1963, 1964, 1966,





Fig. 5. Torbiera di Marcaria (Parco Oglio Sud): le “lame” utilizzate in passato per l'estrazione della torba, ospitanti una ricca fauna ad Hydradephaga con cicli vitali di tipo 1a, 1b e 4 (foto P. Mazzoldi).



Fig. 6. Riserva Naturale di Monticchie: uno dei fossati passanti in mezzo all'alno-saliceto della Riserva, ambiente d'elezione di *Agabus didymus*, insieme a *A. bipustulatus*, *Hydroporus palustris*, *Hygrotus inaequalis* e *Laccophilus minutus* (foto M. Toledo).



Fig. 7. Trappola luminosa a “luce nera”, utilizzata principalmente per studi sui Lepidotteri e Tricotteri presso le Riserve di Le Bine e di Monticchie. L'esame delle catture effettuate con questo strumento ha permesso di ottenere alcune notizie sugli spostamenti notturni in volo di alcune specie di Dytiscidae (foto M. Toledo).



1975, 1978, 1980, 1983, 1985), Nilsson (1986c, 1987, 1989), Nilsson & Carr (1989). Gli stadi larvali sono stati stabiliti in base ai caratteri dati da Galewski (1963, 1964, 1966, 1975), Nilsson (1982), Larson et al. (2000).

I cicli vitali, dedotti dai dati raccolti, sono riferiti e comparati con le categorie date da Nilsson (1986a) e Nilsson & Holmen (1995).

L'ordinamento sistematico-nomenclatoriale segue quello di Nilsson (2001, 2003, 2004) e Balke et al. (2004). Le categorie corologiche, in tab. 3, sono espresse secondo i criteri di Vigna Taglianti et. al (1993).

Il materiale raccolto è conservato per gran parte nella collezione dell'autore, ad eccezione di alcuni esemplari adulti, preparati a secco e depositati presso la Riserva di Le Bine.

## RISULTATI PRELIMINARI

**CICLI VITALI IN PIANURA PADANA.** In base ai dati raccolti, tre tipi fondamentali di cicli vitali sarebbero stati riscontrati finora in pianura padana (figg. 1-2):

1) Specie univoltine e, forse, bi o plurivoltine, che si riproducono durante l'intera o in un breve periodo della bella stagione e che svernano solo da adulti: questa categoria corrisponderebbe al ciclo vitale 1) di Nilsson (1986a) la cui definizione, però, è stata necessariamente modificata rispetto a quella originale. È stato osservato, infatti, che questa categoria in pianura padana è più complessa, dato che le stesse specie che in nord Europa sono tutte univoltine, riproducendosi più o meno nello stesso arco di mesi durante la bella stagione e che svernano come adulti, alle nostre latitudini presentano comportamenti diversi, a seconda della specie. Il ciclo vitale di tipo 1) sensu Nilsson (1986a), in pianura padana può essere diviso in due gruppi fondamentali:

1a) specie univoltine che si riproducono soltanto in un periodo limitato della bella stagione, con larve solo in primavera: *Hydroporus palustris*, forse *H. angustatus*, *Agabus undulatus* e *A. didymus* si riproducono solo in primavera e solo all'inizio di questa stagione sono state osservate le loro larve. Gli adulti della nuova generazione, poi, passerebbero il resto della bella stagione senza riprodursi; svernano in acqua, probabilmente si accoppiano l'anno seguente tra febbraio e aprile e all'inizio della primavera depongono le uova. È stato osservato, per *H. palustris* e *A. undulatus*, che il periodo che intercorre tra la completa scomparsa delle larve dall'acqua, l'impupamento e la comparsa in massa di adulti immaturi varia tra i 10 - 15 giorni. Nella categoria 1a) forse rientra anche *Liopterus haemorroidalis*, le cui larve, però, sono state rinvenute a maggio e in giugno. I dati riguardanti questa specie sono comunque ancora troppo scarsi per una analisi più accurata. De Marzo (1976a) segnala larve di *L. haemorroidalis* a tutti e tre gli stadi in marzo e aprile, in Puglia e Lucania e larve al II e III stadio in giugno nelle Marche, a 700 m dal livello del mare.

1b) specie univoltine, o forse bi o plurivoltine che si riproducono continuamente o in più periodi della bella stagione, con larve in primavera, estate e autunno: questa sottocategoria comprenderebbe la maggioranza delle specie studiate finora in pianura padana: *Hyphydrus ovatus*, le due specie di *Hygrotus* e di *Rhantus* finora studiate, tutte le specie della sottofamiglia Dytiscinae, tranne forse *Hydaticus grammicus* (vedi più avanti), e di Laccophilinae. Tutte queste specie si riproducono ininterrottamente dalla prima metà della primavera ai primi d'autunno, dato che le loro larve sono state osservate in tale periodo,



più o meno a tutti gli stadi di sviluppo. Buona parte di queste specie in Fennoscandia vengono dichiarate univoltine (Nilsson & Holmen, 1995) ed è assai probabile che, vista la brevità della stagione calda, non esista bivoltinismo tra i Dytiscidae a quelle latitudini. Il comportamento osservato in pianura padana, invece, può far pensare che almeno alcune di queste specie, da noi, siano bivoltine o plurivoltine, cioè che la nuova generazione prodotta in primavera dagli individui dell'anno precedente, contribuisca alla produzione di un'altra o più generazioni nell'estate e/o autunno dello stesso anno. Tale differenziamento delle caratteristiche bionomiche tra popolazioni della stessa specie a latitudini diverse, non dovrebbe stupire troppo quando si ha a che fare con taxa ad ampia distribuzione e non è un fenomeno nuovo in entomologia (Tauber & Tauber, 1981; Brown & Hodek, 1983). Ciononostante, fino ad ora non è stato documentato con certezza nessun caso di plurivoltinismo tra i Dytiscidae europei, se si fa eccezione di *Hydroglyphus geminus* (Fabricius, 1792) che, nella Spagna settentrionale, sembrerebbe avere anche quattro generazioni per estate (Velasco, 1989; Ribera et al. 1995), ed è altrettanto possibile che queste specie siano invece monovoltine anche alle nostre latitudini e che, quindi, gli adulti nati in primavera o in estate siano impossibilitati a riprodursi prima dell'anno successivo. La questione necessita studi più approfonditi.

Per quanto riguarda *Hydaticus grammicus*, fino al 2000 erano state rinvenute larve di questa specie solamente tra agosto e settembre e adulti immaturi tra settembre e ottobre (ma anche ai primi di settembre, nel 1989, presso la località 12). Questo suggeriva, bene o male, un ciclo di tipo 1a), sebbene con riproduzione in tarda estate-autunno invece che in primavera. Il recente ritrovamento di una singola larva III nel maggio 2004 (Toledo, 2004), unico esemplare in una buca colma di larve di Culicidae (Diptera) e larve di *Rhantus suturalis*, fa ritenere che la specie abbia un periodo riproduttivo più esteso, sebbene strettamente dipendente dalla disponibilità di corpi d'acqua a regime effimero o comunque temporaneo e ad alta produttività. Uno studio mirato sulla biologia di questa specie è attualmente in corso.

4) Specie semivoltine che si riproducono in estate e passano il primo inverno come larve ed il secondo inverno come adulti: tipici rappresentanti di questa categoria sono le specie di *Ilybius* del gruppo *subaeneus* (sensu Nilsson, 2001). Come in nord Europa, anche in pianura padana il ciclo vitale di queste specie è caratterizzato dal tardo periodo riproduttivo (estate in nord Europa, settembre-ottobre alle nostre latitudini), con larve che nascono in autunno, svernano in acqua al terzo stadio, per poi impuparsi nella primavera successiva. Adulti immaturi sono stati osservati tra la seconda metà di maggio e giugno e in questo periodo individui immaturi di *I. quadriguttatus* sono stati catturati nelle trappole luminose. Questo suggerirebbe un periodo di pupa e/o di permanenza degli adulti nelle cellette, prolungato rispetto alle specie delle categorie precedenti e, almeno per quest'ultima specie, la dispersione delle imago immature verso altri corpi d'acqua. Secondo Nilsson (1986a), una volta sfarfallati i nuovi adulti non si riprodurrebbero, fino all'autunno dell'anno successivo, trascorrendo l'inverno probabilmente fuori dall'acqua, sotto sassi o legni morti (Galewski, 1966; Nilsson, 1986a). Ciononostante, a Terranova (Canada), Hicks & Larsson (1995) attribuiscono a quattro specie di *Ilybius* del gruppo *subaeneus* (di cui una, *I. angustior* Gyllenhal, 1808, presente anche in nord Europa) un ciclo vitale simile a quel-



lo descritto da Nilsson (1986a), con la differenza che la maggior parte degli adulti, emergenti dalla cella pupale agli inizi dell'estate, hanno un periodo riproduttivo univoltino, riproducendosi l'estate stessa in cui sono sfarfallati. Solo una piccola percentuale (15%) emerge in estate più avanzata, per poi svernare e deporre le uova l'estate successiva, completando così un ciclo di tipo semivoltino. Questa differenza rispetto il ciclo vitale descritto da Nilsson (1986a) per le specie di *Ilybius* Erichson, 1832 in Svezia, si imputerebbe, secondo i due autori, al prolungato periodo invernale in Svezia rispetto a Terranova. Infatti nella prima gli specchi d'acqua sarebbero liberi dai ghiacci per un periodo più breve e le specie di *Ilybius* di tale territorio non avrebbero il tempo sufficiente per emergere e ovodeporre nel corso della stessa estate. Questo lascia aperte parecchie congetture sulla possibile flessibilità del periodo riproduttivo delle specie di *Ilybius* del gruppo *subaeneus*. L'Italia, ad esempio, dove in inverno gli specchi d'acqua sono coperti dai ghiacci (almeno in pianura) per un periodo molto breve o addirittura nullo, può essere interessata dalle stesse differenze rispetto l'Europa settentrionale; probabilmente in maniera ancora più spinta al centro-sud, dove, tra l'altro, è presente *I. meridionalis* Aubé, 1836: specie non ancora studiata da questo punto di vista, a geonemia e, con ogni probabilità, biologia riproduttiva diversa rispetto le altre specie di *Ilybius* del gruppo *subaeneus* in Europa (ciononostante Ribera et al. (1995) segnalano larve di questa specie in gennaio, per l'area pirenaica, confermando almeno in parte che *I. meridionalis* ha larve svernanti in inverno, come le altre specie del gruppo *subaeneus*).

5) Specie con periodo riproduttivo flessibile, che svernano sia come larve che adulti: come in nord e centro Europa, anche in pianura padana *Agabus bipustulatus* sicuramente si riproduce in un arco temporale molto esteso e le sue larve tardive svernano in acqua insieme agli adulti. Di questa specie sono state trovate larve dei diversi stadi in primavera e autunno e larve mature in inverno. Il rinvenimento, inoltre, di una larva al I stadio alla fine di novembre, lascia supporre per questa specie ovodeposizioni continuate almeno fino alla fine dell'autunno (tab. 2). Come nel caso delle specie del ciclo 1b) è possibile che anche questa specie sia bivoltina o plurivoltina. Probabilmente *Colymbetes fuscus* ha comportamento analogo in pianura padana, dato che sono state trovate alcune larve mature di questa specie già i primi di marzo, oltre che aprile e maggio (tab. 2). Ma i dati finora disponibili sono troppo scarsi per qualsiasi affermazione. Alla specie viene attribuito un ciclo vitale di tipo 1 per Polonia (Galewski, 1964), Inghilterra (Carr, 1989) e Fennoscandia (Nilsson & Cuppen, 1988; Nilsson & Holmen, 1995), con larve in primavera o in estate. In pianura padana, il ritrovamento di larve mature in marzo, invece suggerirebbe un comportamento più vicino a quello riportato da Bertrand (1928) e Meinert (1901) in Francia e Danimarca, con larve anche nei mesi invernali, che lasciano pensare o a un periodo riproduttivo che si protrae anche durante la cattiva stagione, oppure alla deposizione delle uova prolungata fino all'autunno, con larve che svernano, come nel caso di *A. bipustulatus* e *Ilybius* del gruppo *subaeneus*.

Nella fig. 1 sono schematizzati, da Nilsson (1986a) modificato, i tipi di cicli vitali finora riscontrati in pianura padana, confrontati con gli equivalenti conosciuti per il nord Europa. Il numero 5 è stato omesso a causa della sua flessibilità. Per il ciclo vitale 1b sono illustrate le due possibili alternative: monovoltinismo (con linee punteggiate tra la fase terrestre e



quella acquatica, a specificare il fatto che i nuovi nati non si riproducono per quel dato anno e la produzione di uova è affidata sempre agli individui dell'anno precedente); bi o plurivoltinismo (con alternanza di generazioni durante lo stesso anno). Lo schema del ciclo 1a è riferito a riproduttori precoci quali *Hydroporus palustris* e *Agabus undulatus*.

Le specie che ogni anno si riproducono regolarmente e in abbondanza e i cui stadi giovanili risultano dominanti di numero rispetto a quelli di altri taxa, costituiscono il nucleo (core) di una data biocenosi (Nilsson, 1986a, 1986b). Le core-species sono individuate in base alla frequenza con cui sono rinvenute le larve, nel corso di campionamenti di tipo semiquantitativo protratti negli anni. L'individuazione delle core-species in una data comunità è uno strumento che permette di definirne con efficacia il profilo e di monitorarne efficacemente gli andamenti nel corso degli anni.

Una sufficiente mole di dati è stata raccolta per la Riserva di Le Bine nel corso degli anni 1996, 1999 e 2000 (Toledo, 2000), principalmente presso un piccolo stagno a carattere stagionale, sottoposto a forti variazioni annuali del livello idrico. I diagrammi esposti nella tab. 4 sono stati realizzati su una idea di Carr (1989) in parte modificata, e mostrano di quali specie sono state rinvenute larve con una certa regolarità. In questi diagrammi si vede come solo due specie - *Hydroporus palustris* e *Agabus undulatus* - hanno conservato costantemente caratteristiche di core-species nel corso dei tre anni di indagine, permettendo di affermare che queste rappresentano i riproduttori dominanti dell'intera comunità a Dytiscidae di questo stagno. Questa affermazione si adatta alla presenza relativamente costante degli adulti delle due specie durante il periodo dei rilievi.

Per finire, i dati suesposti per Le Bine si prestano per un breve confronto con quelli pubblicati da Nilsson (1986b) per uno stagno stagionale della Svezia settentrionale e con quelli di Carr (1989) per uno stagno stagionale dell'Inghilterra sud orientale. Solo 2 specie (*Hydroporus palustris* e *Agabus undulatus*) su un totale di 22 segnalate si sono rivelate quale core-species del succitato stagno nella Riserva di Le Bine; il biotopo studiato da Nilsson (1986b), invece, presentava 10 core-species su 33, mentre quello trattato da Carr (1989) era caratterizzato da 2 core-species su 7. In tutti e tre i casi si può dire che le core-species si dividono in due corporazioni fondamentali ("guilds") (Nilsson 1986b) per taglia e selezione predatoria e in tutte e tre le località queste due corporazioni sono rappresentate da specie del genere *Hydroporus* Clairville, 1806 e *Agabus* Leach, 1817. Una delle differenze principali tra lo stagno di Le Bine e quello in Svezia settentrionale è il fatto che in quest'ultimo le due "guilds" sono distinte anche dall'avere ciclo vitale di diverso tipo (rispettivamente 1 e 3), mentre nel primo le due "guilds" hanno entrambe ciclo vitale di tipo 1a). Il differenziamento in corporazioni delle core-species all'interno di una biocenosi, lascia presumere che il maggior successo riproduttivo sia anche legato a differenze sostanziali delle esigenze delle larve di specie diverse, onde abbassare il più possibile il livello di competizione tra le stesse; la coesistenza, quindi, di un elevato numero di larve dello stesso tipo morfobiotico e con stesso tipo di ciclo vitale in un dato biotopo sarebbe tollerabile solo se limitato a poche specie (Galewski, 1973; Nilsson 1986a). Quest'ultimo aspetto rimane comunque poco chiaro, dato che non è stato né provato né veramente confutato (es. Ranta, 1982; Nilsson, 1986b) e difficile è in verità trovare un criterio che sia valido a livello generale.



AMBIENTI DI RIPRODUZIONE. Gli ambienti di riproduzione, o per lo meno di ovodeposizione; in ultima analisi, cioè, gli ambienti destinati allo sviluppo delle larve, possono essere gli stessi in cui gli adulti vivono abitualmente oppure no (Galewski, 1971). In pianura padana, finora, è stato riscontrato che tendenzialmente il grosso delle specie depone le uova negli stessi ambienti d'elezione degli adulti, mentre una minoranza predilige ambienti a regime effimero, ma altamente produttivi, che gli adulti raggiungerebbero in volo appositamente. *Rhantus suturalis* e *Hydaticus grammicus* apparterrebbero tipicamente a quest'ultima categoria, con larve che si sviluppano, rispettivamente, in preferenza o esclusivamente in ambienti temporanei (pozze meteoriche, prati allagati, ecc.) popolati in gran numero da stadi preimmaginali di Ditteri, soprattutto Culicidae. Le larve di queste specie di Dytiscidae hanno probabilmente, come osservato in altre specie (Kingsley, 1985; Gewecke & Rostock, 1986), un ciclo piuttosto rapido per potersi sviluppare in ambienti di durata incerta. Anche *Acilius sulcatus* pare essere un colonizzatore degli habitat più disparati per riprodursi, purché poco profondi, con uno sviluppo larvale piuttosto breve e che approfitterebbe dei periodi di secca per impuparsi (Carr, 1989; Denton, 1995). Nel territorio in esame è stato osservato che questa specie, in pianura, si riproduce in maniera sporadica in diversi tipi di ambienti ad acque ferme, per lo più a regime stagionale più che a carattere effimero. Un comportamento simile è stato segnalato anche per l'affine *A. canaliculatus* (Nicolai, 1822) in Inghilterra (Carr, 1988). In accordo con Galewski (1963) *Rhantus grapii*, al contrario, prediligerebbe da adulto ambienti a carattere temporaneo, purché ricchi di vegetazione e detrito organico, raggiungendo stagni e paludi più stabili per lo sviluppo della sua progenie.

Tra le specie con larve che si sviluppano negli stessi ambienti in cui vivono gli adulti, poche sono quelle legate ad una ristretta tipologia ambientale, per lo meno nell'ambito delle acque ferme. *Agabus undulatus* è specie brachittera, incapace di volare (Jackson, 1956; Franciscolo, 1979; Nilsson & Holmen, 1995; Toledo, dati inediti), alquanto localizzata in nord Italia (cfr. Mazzoldi, 1987), sebbene localmente può risultare abbondante. In accordo con Galewski (1971, 1980) questa specie predilige piccoli stagni ricchi di vegetazione, spesso a carattere stagionale, soggetti cioè a drastiche variazioni del livello d'acqua nel corso dell'anno. In pianura padana le larve di questa specie sarebbero tra le prime a comparire in primavera e sono del tipo nuotatrici-deambulanti (Galewski, 1971), con sviluppo piuttosto rapido che le porta ad abbandonare già a maggio il mezzo acquatico per impuparsi. Non essendo in grado di raggiungere in volo altri siti, come invece può la maggioranza delle altre specie di Dytiscidae, a Le Bine è stato notato che gli adulti di questa specie, sfarfallati in massa tra maggio e giugno, estivano in luglio e agosto anche se non è avvenuto il totale prosciugamento del loro ambiente e gli adulti di altre specie coabitanti sono ancora in attività. In settembre, con le prime piogge, gli adulti di *A. undulatus* ricompaiono nello stagno e ivi svernano.

Nelle tabb. 2-3 sono riassunti i dati qui discussi. Per ogni specie trattata vengono specificati i mesi in cui sono state osservate le larve e a quale stadio di sviluppo, nonché gli ambienti di elezione per la riproduzione e i cicli vitali riscontrati in pianura padana, confrontati con quelli conosciuti per il nord Europa. Una bibliografia selezionata sull'argomento, infine, viene fornita per ogni specie.



Tab. 2. Tabella riassuntiva delle caratteristiche bionomiche delle specie di Dytiscidae studiate finora in pianura padana. Abbreviazioni: 1, 2, ... 11 = mesi; I, II, III = stadi larvali rinvenuti in corrispondenza dei mesi; \* = solo larve ottenute ex ovo in laboratorio; \*\* = anche larve ottenute ex ovo in laboratorio.

sottofamiglia	specie	occorrenza larve osservate: mesi (stadi larvali)	ambiente di riproduzione
Hydroporinae	<i>Hyphydrus ovatus</i>	4(I, II*), 5(III**), 6(III), 7(III), 9(III)	pozze, stagni, fossati con vegetazione
	<i>Hygrotus inaequalis</i>	4(I*, II*, III), 5(III*), 6(III), 9(III)	ambienti stagnanti permanenti
	<i>Hygrotus impressopunctatus</i>	5(II, III), 7(III), 8(II, III)	pozze, stagni più o meno permanenti
	<i>Hydroporus palustris</i>	4(I, II, III), 5(II, III)**	diversi tipi di acque ferme o debolm. correnti
	<i>Hydroporus angustatus</i>	4(I*, II*, III*), 5(III*)	paludi, in acque basse, ricche di detrito
Copelatinae	<i>Liopteris haemorroidalis</i>	5(II), 6(I, II, III)	paludi, stagni permanenti, ricchi di vegetazione
Agabinae	<i>Agabus undulatus</i>	4(I, II, III), 5(II, III), 6(III)	stagni a carattere stagionale, ricchi di vegetazione
	<i>Agabus didymus</i>	5(II, III)	acque debolm. correnti, ossigenate e con vegetazione
	<i>Agabus bipustulatus</i>	1(III), 3(III), 4(I, II, III), 5(I, II, III), 10(III), 11(I)	varie tipologie di stagni, pozze, fossati
	<i>Ilybius ater</i>	1 (III), 2(III), IX (I, II), 10(I, II, III), 9(I), 10(I, III)	paludi, stagni, fossati permanenti
	<i>Ilybius quadriguttatus</i>	9(I), 10(I, III)	paludi, stagni permanenti con vegetazione
Colymbetinae	<i>Ilybius fuliginosus</i>	4(III), 9(I, II), 10(II, III)	acque debolm. correnti, ricche di vegetazione
	<i>Ilybius subaeneus</i>	1(III), 3(III), 9(I), 10(II, III)	paludi poco profonde, stagni erbosi, anche stagionali
	<i>Rhantus grapii</i>	4(I, II, III), 5(I, II, III), 6(II), IX (II, III)	stagni permanenti o stagionali, ricchi di vegetazione
	<i>Rhantus suturalis</i>	4(I, III), 5(II, III), 6(III), 7(II), 9 (I, II, III)	pozze, stagni, raccolte d'acqua permanenti o temporanee
	<i>Colymbetes fuscus</i>	3(III), 4(III), 5(III)	stagni permanenti o stagionali, ricchi di vegetazione
Dytiscinae	<i>Hydaticus seminig</i>	4(I, II, III), 5(I, II, III), 6(II, III), 7(I, II, III), 8(II, III), 9(I, II, III), 10(III)	stagni permanenti o stagionali, ricchi di vegetazione
	<i>Hydaticus transversalis</i>	4(I, II, III), 5(I, II, III), 7(I, II, III), 8(II, III), 9(I, II, III), 10(III)	stagni permanenti o stagionali, ricchi di vegetazione
	<i>Hydaticus grammicus</i>	5 (III), 9(II, III), 10(III)	stagni, pozze a carattere effimero, con vegetazione
	<i>Graphoderus cinereus</i>	5(I, II), 6(I, II, III), 7(III)	stagni permanenti o stagionali
	<i>Acilius sulcatus</i>	4(II), 5(I, II, III), 8(III)	pozze e stagni, permanenti o temporanei
Laccophilinae	<i>Dytiscus marginalis</i>	3(I), 4(I, II, III), 5(I, II, III), 6(I, II, III), 7(I)	pozze, stagni, fossati, paludi, stabili e non
	<i>Cybister lateramarginalis</i>	5(I, II, III), 6(I, II), 7(I, II, III)	stagni permanenti, ricchi di vegetazione
	<i>Laccophilus minutus</i>	5(III), 6(III), 7(II, III)	diversi tipi di acque ferme, con o senza vegetazione
	<i>Laccophilus poecilus</i>	4(III), 7(II, III), 8(III), 9(III)	stagni, fossati a carattere permanente o stagionale



Tab. 3. Tabella riassuntiva delle caratteristiche bionomiche delle specie di Dytiscidae studiate finora in pianura padana. Nella colonna “Ciclo vitale in nord Europa” il ciclo 1 è nel senso di Nilsson (1986a). Per ogni specie è stata selezionata una bibliografia essenziale con particolare riferimento ai cicli vitali, se conosciuti, e/o alla morfologia larvale. Abbreviazioni: numeri delle località = vedi tab. 1; \* = solo larve ottenute ex ovo in laboratorio.

specie	località di rinvenimento	di larve	ciclo vitale	corologia	ciclo vitale in nord Europa	bibliografia selezionata
<i>Hyphidrus ovatus</i>	1, 2, 5, 6, 7	1b		sibirico-europeo	1	Bertrand, 1928; Nilsson & Holmen, 1995; Friis et al. 2003
<i>Hygrotus inaequalis</i>	1, 2	1b		sibirico-europeo	1	Bertrand, 1928; Nilsson & Holmen, 1995
<i>Hygrotus impressopunctatus</i>	1, 4, 11	?1b		olartico	1	Bertrand, 1928; Nilsson & Holmen, 1995
<i>Hydroporus palustris</i>	1, 2, 3	1a		sibirico-europeo	1	Nilsson, 1989; Nilsson & Holmen, 1995
<i>Hydroporus angustatus</i>	1*, 2*	?1a		sibirico-europeo	sconosciuto	Nilsson, 1989
<i>Liopteris haemorroidalis</i>	1	?1a		sibirico-europeo	non specificato	De Marzo, 1976a
<i>Agabus undulatus</i>	1, 7	1a		turanico-europeo	1	Galewski, 1980; Nilsson, 1986
<i>Agabus didymus</i>	2, 8, 9	1a		europeo-mediterraneo	non specificato	Galewski, 1980; Nilsson, 1986
<i>Agabus bipustulatus</i>	1, 2, 4, 5, 11	5		paleartico-afrotropicale	5	Galewski, 1980; Nilsson, 1986
<i>Ilybius ater</i>	1, 2, 11	4		sibirico-europeo	4	Galewski, 1966; Nilsson, 1986
<i>Ilybius quadriguttatus</i>	1, 2	4		europeo	4	Galewski, 1966; Nilsson, 1986
<i>Ilybius fuliginosus</i>	1, 2, 9, 10	4		centroasiatico-europeo	4	Galewski, 1966; Nilsson, 1986
<i>Ilybius subaeneus</i>	11	4		olartico	4	Galewski, 1966; Nilsson, 1986
<i>Rhantus grapii</i>	1, 3	1b		centroeuropeo	?1	Galewski, 1963
<i>Rhantus suturalis</i>	1, 2, 3, 4, 6, 7, 11	1b		subcosmopolita	non specificato	Galewski, 1963
<i>Colymbetes fuscus</i>	1, 11	?5		centroasiatico-europeo-mediterraneo	1	Galewski, 1964; Nilsson & Cuppen, 1988
<i>Hydaticus seminiger</i>	1, 2, 3, 4, 5, 6, 7, 11	1b		sibirico-europeo	non specificato (univoltino)	Galewski, 1983; Nilsson & Holmen, 1995
<i>Hydaticus transversalis</i>	1, 2, 3, 4, 5, 6, 7, 11	1b		sibirico-europeo-E mediterraneo	non specificato (univoltino)	Galewski, 1983; Nilsson & Holmen, 1996
<i>Hydaticus grammicus</i>	1, 11,12	?1b		centroasiatico-europeo	sp. estranea	Dettner, 1984
<i>Graphoderus cinereus</i>	1, 3, 5	?1b		centroasiatico-europeo	non specificato	Galewski, 1990
<i>Acilius sulcatus</i>	1, 2, 6	1b		sibirico-europeo	non specificato (univoltino)	Dettner, 1982; Gewecke et al. 1986; Nilsson & Holmen, 1995
<i>Dytiscus marginalis</i>	1, 2, 3, 4, 6, 7	1b		sibirico-europeo	1	Nilsson & Holmen, 1995
<i>Cybister lateramarginalis</i>	1, 3	1b		turanico-europeo-mediterraneo	1	Nilsson & Holmen, 1995
<i>Laccophilus minutus</i>	1, 4, 6, 8, 11	1b		paleartico	1	De Marzo, 1976b; Galewski, 1978
<i>Laccophilus poecilus</i>	1, 5, 6, 8, 11	1b		centroasiatico-europeo-mediterraneo	non specificato	De Marzo, 1976b; Galewski, 1978



Tab. 4. Core-species: andamento in un periodo di tre anni, delle specie che si riproducono in maggior abbondanza presso un biotopo nella Riser-  
va di Le Bine. Abbreviazioni: L I, L II, L III = stadi larvali; f = frequente (da maggiore di 5 a 5); o = occasionale (da minore di 5 a 3); s = scarso  
(minore di 3); - = assenza. Le frequenze (f, o, s), riprese secondo Carr (1989), sono espresse dal conteggio del numero di larve raccolte nel corso  
di ogni campionamento, diviso per il numero di campionamenti mensili.

1996				1999				2000			
specie e stadi larvali				specie e stadi larvali				specie e stadi larvali			
<i>Hygrotus inaequalis</i>				<i>Hygrotus inaequalis</i>				<i>Hyphodrus ovatus</i>			
L III	-	-	-	L III	-	-	-	L III	-	-	-
<i>Hydroporus palustris</i>	-	-	-	<i>Hydroporus palustris</i>	-	-	-	<i>Hydroporus palustris</i>	-	-	-
L II	s	-	-	L II	-	-	-	L III	-	-	-
L III	f	-	-	L III	-	-	-	<i>Agabus undulatus</i>	-	-	-
<i>Agabus undulatus</i>	-	-	-	<i>Agabus undulatus</i>	-	-	-	L II	-	-	-
L I	s	-	-	L III	-	-	-	L III	-	-	-
L III	f	-	-	<i>Rhantus suturalis</i>	-	-	-	<i>Rhantus suturalis</i>	-	-	-
<i>Ilybius quadriguttatus</i>	-	-	-	L I	-	-	-	L I	-	-	-
L I	-	-	-	L II	-	-	-	L II	-	-	-
<i>Rhantus grapii</i>	-	-	-	L III	-	-	-	L III	-	-	-
L I	s	-	-	<i>Hydaticus grammicus</i>	-	-	-	<i>Hydaticus grammicus</i>	-	-	-
L II	s	-	-	L II	-	-	-	L II	-	-	-
L III	f	-	-	L III	-	-	-	L III	-	-	-
<i>Hydaticus transversalis</i>	-	-	-	<i>Hydaticus transversalis</i>	-	-	-	<i>Hydaticus transversalis</i>	-	-	-
L I	o	s	-	L I	-	-	-	L I	-	-	-
L II	o	f	-	L II	-	-	-	L II	-	-	-
L III	f	f	-	L III	-	-	-	L III	-	-	-
<i>Dytiscus marginalis</i>	-	-	-	<i>Dytiscus marginalis</i>	-	-	-	<i>Dytiscus marginalis</i>	-	-	-
L I	f	o	-	L I	-	-	-	L I	-	-	-
L II	s	s	-	L II	-	-	-	L II	-	-	-
L III	-	f	-	L III	-	-	-	L III	-	-	-



CICLO ANNUALE TIPO IN BIOTOPHI AD ACQUE FERME IN PIANURA PADANA. La sequenza esposta di seguito è grosso modo il sunto di osservazioni effettuate nel corso degli anni, prevalentemente presso la Riserva di Le Bine, nella quale sono presenti biotopi ad acque ferme con caratteristiche alquanto diverse tra loro. Questo ha permesso, nello spazio di poche centinaia di metri, di poter monitorare efficacemente e con agio gli andamenti annuali presso tipologie ambientali differenti e, di conseguenza, avere anche un'idea sugli eventuali spostamenti di alcune specie per fini riproduttivi.

Primavera (marzo-aprile): comparsa delle prime larve - prevalentemente I, II stadio - delle specie con ciclo vitale 1a) e 1b). Contemporaneamente a queste nuove larve è possibile trovare le larve mature di *Ilybius* spp, *Agabus bipustulatus* e *Colymbetes fuscus*, nate l'anno precedente e che hanno svernato nel corpo d'acqua. Queste ultime abbandonano l'acqua in aprile per impuparsi nel terreno.

Primavera (aprile-maggio, primi di giugno): prevalentemente larve al II e III stadio delle specie primaverili con ciclo 1a) e delle specie con ciclo 1b). Solitamente già verso la metà di maggio le larve delle specie con ciclo 1a) sono scomparse dal corpo d'acqua e tra maggio e giugno avviene la fuoriuscita delle nuove immagini dalle cellette pupali, sicché in questo periodo lo specchio d'acqua è frequentato da adulti immaturi di queste specie. In maggio e giugno sono state trovate larve II e III di *Liopterus haemorroidalis*, probabilmente anch'esso con ciclo 1a) ma, forse, più tardivo. Larve delle specie con ciclo 1b) e 5) vengono rinvenute a tutti gli stadi larvali. Tra maggio e giugno compaiono anche adulti immaturi di *Ilybius* del gruppo *subaeneus*, che allo stadio di larva matura erano andate ad impuparsi in aprile.

Estate: Riproduzione continuata per le specie a ciclo 1b) e 5) con larve ai diversi stadi. Solo condizioni drastiche di deficit idrico possono interrompere brevemente il periodo riproduttivo. Adulti immaturi di queste specie sono stati trovati sporadicamente, in quantità minori per volta e in mesi diversi durante l'anno (finora giugno, luglio, agosto).

Fine estate-autunno: Larve giovani (I stadio) delle specie con ciclo vitale di tipo 4) (*Ilybius* del gruppo *subaeneus*) sono state osservate in gran numero a settembre, e in ottobre sono state trovate ancora, insieme a larve al II e III stadio. In settembre si trovano ancora larve delle specie con ciclo 1b) e tra agosto e settembre sono state rinvenute, finora, quasi tutte le larve di *Hydaticus grammicus*, mentre tra settembre e ottobre sono stati ritrovati adulti più o meno immaturi di questa specie, negli stessi ambienti di sviluppo delle larve. *Rhantus suturalis*, specie con preferenze riproduttive simili a quelle di *H. grammicus*, è la specie le cui larve solitamente convivono con quelle di quest'ultima, in media con un rapporto di circa 10/1 a favore della prima. Ciononostante *R. suturalis* è estremamente euriecia, sia nella scelta degli ambienti di riproduzione (larve di questa specie sono state trovate anche in paludi stabili, sebbene in minor concentrazione) che nel periodo di riproduzione: assai probabilmente ininterrotto da aprile a ottobre, salvo periodi di forte deficit idrico nei mesi più caldi.

Inverno: Poche raccolte sono state effettuate in inverno finora. È stato confermato che varie specie svernano come adulti in acqua (*Hygrotus* spp, *Hydroporus* spp, *Agabus* spp e *Rhantus suturalis*), laddove risulta accertato che *Agabus bipustulatus* e le specie di *Ily-*



*bicus* del gruppo *subaeneus* svernano anche come larva matura; per quel poco che è stato possibile osservare, con ogni probabilità pure *Colymbetes fuscus* svernerebbe anche sotto forma di larva al terzo stadio. Ancora non è stato provato che gli adulti di *Ilybius* del gruppo *subaeneus* trascorrono l'inverno all'asciutto, come indicato in letteratura per l'Europa centrale e settentrionale (Galewski, 1966; Nilsson, 1986a), ma è probabile che ulteriori ricerche permetteranno di confermare questo dato anche in pianura padana.

## DISCUSSIONE

Confrontando i risultati qui esposti con quelli conosciuti per l'Europa settentrionale, la differenza che risalta maggiormente è il periodo riproduttivo prolungato delle intere comunità a Dytiscidae (fig. 2), nell'arco che va dalla primavera all'autunno: con un netto anticipo per le specie le cui larve compaiono precocemente e un deciso ritardo per quelle con larve tardive. I motivi di ciò sono facilmente intuibili, vista la maggior durata della bella stagione alle nostre latitudini. Il prolungato periodo riproduttivo comporta che in pianura padana gli stadi preimmaginali di specie diverse nascono e si sviluppano in momenti diversi dell'anno, anche assai distanti; contrariamente a ciò che avviene in nord Europa dove, invece, è possibile osservare le larve di quasi tutte le specie coesistere nei pochi mesi a disposizione per il loro sviluppo. Una conseguenza di questo fenomeno è la maggior complessità all'interno del ciclo tipo 1) vista in precedenza; apparentemente uniforme in Fennoscandia, alle nostre latitudini questa categoria vede, sostanzialmente, una divisione in due sottocategorie ben diverse: una con periodo riproduttivo limitato a pochi mesi e sicuramente univoltina; l'altra con specie che depongono uova in continuazione da aprile a settembre e per le quali è possibile sospettare bi o plurivoltinismo, almeno per alcune di esse. Dalla letteratura si evince che in Europa centrale (perlomeno Polonia: Galewski 1963, 1964, 1966, 1971, 1975, 1978, 1980, 1983, 1985, 1990; Inghilterra: Carr, 1989) le differenze nell'ambito del suddetto ciclo sarebbero più abbozzate rispetto al nostro territorio, ma comunque già con un certo differenziamento dei periodi riproduttivi nella bella stagione e un leggero anticipo (a seconda della latitudine e del clima locale) del periodo riproduttivo in primavera (circa tra aprile e maggio) e un ritardo analogo (tra agosto e settembre) per i riproduttori autunnali.

Un'altra differenza importante riscontrata alle nostre latitudini rispetto al nord Europa è un periodo preimmaginale (larva e pupa) in generale più breve, rispetto a quello di imago.

Gli altri due tipi di cicli vitali riconosciuti finora in pianura padana - il 4 ed il 5 - non differiscono di molto rispetto alle definizioni date da Nilsson (1986a) per l'Europa settentrionale. Il ciclo n. 4) riguarda le specie di *Ilybius* del gruppo *subaeneus*, che tipicamente depongono le uova in autunno, decisamente più tardi rispetto alle popolazioni più nordiche (settembre-ottobre, rispetto luglio-agosto), mentre anticipato sarebbe l'abbandono del corpo d'acqua da parte delle larve mature (aprile, invece di giugno) (fig. 2). L'unica specie finora accertata con sicurezza quale rappresentante del ciclo vitale n. 5) - *Agabus bipustulatus* - avrebbe in effetti periodo riproduttivo flessibile, sebbene con ogni probabilità interrompa o perlomeno rallenti l'ovodeposizione nel pieno della cattiva stagione. Se così fosse, questo periodo di ridotta attività sarebbe più breve in pianura padana,



rispetto alle latitudini più settentrionali. Il caso di *Colymbetes fuscus*, accennato precedentemente, suggerirebbe, a mio avviso, che alcune specie in Italia ed Europa meridionale in genere, possono avere un periodo riproduttivo più flessibile, diverso da quello osservato in Fennoscandia, riconducibile sostanzialmente ad un ciclo simile a quello che caratterizza *Agabus bipustulatus* in gran parte del suo vasto areale di distribuzione. *Hydroporus memnonius* Nicolai, 1822 è un'altra specie che in Europa settentrionale avrebbe ciclo di tipo 5 (Nilsson & Holmen, 1995) e che è presente in pianura padana, sebbene piuttosto rara e sporadica (Focarile, 1960; Franciscolo, 1979). Non è stato possibile ottenere dati su questa specie finora, data la scarsità dei ritrovamenti; è stato osservato comunque che gli adulti si rinvenivano solamente all'inizio della primavera, dopodiché risultano introvabili, mentre ancora non sono state raccolte larve. In marzo, poche volte, è stato rinvenuto qualche esemplare immaturo, il che potrebbe suggerire che anche da noi questa specie ha ciclo vitale di tipo 5); d'altra parte Nardi & Maltzeff (2001) segnalano catture di immaturi di questa specie anche in dicembre, in provincia di Roma, supportando quindi tale ipotesi.

Gli altri due tipi di cicli vitali (n. 2 e n. 3) definiti da Nilsson (1986a) non sono ancora stati riscontrati nel territorio in esame. Il primo (ciclo n. 2) è conosciuto finora solo per due specie estranee alla fauna italiana e la sua presenza nel nostro Paese è da ritenersi improbabile. Il secondo (ciclo n. 3) invece caratterizzerebbe un numero maggiore di Dytiscidae, tra cui le specie di *Ilybius* del gruppo *chalconatus*. Nella pianura padana questo gruppo è rappresentato da due specie, che non è stato possibile studiare finora: *Ilybius chalconatus* (Panzer, 1796), segnalato per poche località dell'alta pianura lombarda (Bilardo, 1965; Franciscolo, 1979) e *I. pseudoneglectus* (Franciscolo, 1972), relativamente più comune nella pianura a sud del Po (Toledo, dati inediti) ed estranea alla fauna del nord Europa. È quantomeno probabile che anche da noi queste due specie siano caratterizzate da un ciclo vitale - il ciclo numero 3) - non ancora riscontrato nella presente indagine; per questo motivo un prossimo progetto di studio riguarderà almeno una di queste due specie, sebbene presenti difficoltà dovute alla loro relativa rarità in pianura padana e, soprattutto, alla necessità di seguirne il ciclo e ottenere uova durature in cattività, che riescano a rimanere in vita fino al momento della schiusa.

Le ricerche fin qui svolte hanno dato dei primi risultati, necessariamente incompleti e sicuramente suscettibili di modifiche. Ciononostante, da essi comincia a delinearsi una prima, seppur abbozzata, idea della biologia riproduttiva dei Dytiscidae nell'Italia settentrionale, confermando differenze clinali anche consistenti tra popolazioni di latitudini diverse, ipotizzate già da Nilsson (1986a). Naturalmente sono necessari ulteriori studi, su altre specie e su porzioni più vaste di territorio, ma anche nuovi approfondimenti sugli stessi taxa trattati in questa sede, per poter avere, col tempo, una visione più chiara ed unitaria dell'argomento.

#### RINGRAZIAMENTI

Desidero ringraziare gli amici Lorenzo Pizzetti (Parma) e Paolo Mazzoldi (Brescia), compagni di uscite e preziosi consiglieri; Cristina Menta (Università di Parma) per il suo supporto morale; Francesco Cecere e Andrea Agapito Ludovici (Riserva di Le Bine, WWF Lombardia), Fulvio De Asmundis (WWF Somaglia) e Susanna Perlini (Parco Oglio Sud) per avermi dato am-



pia facoltà di campionare nei diversi biotopi menzionati e per la loro amichevole disponibilità; Gianpaolo Bosi (Milano) per avermi gentilmente fornito i preziosi dati riguardanti gli ambienti di L'Ercolana e, infine, il prof. Vittorio Parisi (Università di Parma) per la sua costante disponibilità. Si ringrazia, infine, l'appoggio fornito dal Progetto Centri di Monitoraggio per la Biodiversità in Lombardia (1999-2000), patrocinato dalla Fondazione Lombardia Ambiente e dal WWF Lombardia.

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## Taxonomic revision of the Ethiopian genus *Canthyporus* (Coleoptera Dytiscidae)

**Abstract** - The genus *Canthyporus* Zimmermann, 1919, is revised. A total of 35 species are recognized, all of them distributed within the Ethiopian Region, and with a centre of diversity in the South African Western Cape province. Descriptions of all species are given together with illustrations of habitus and male and female genitalia. A key to species (males), distribution maps, and ecological information are provided. Four new species are described from South Africa: *Canthyporus aenigmaticus* n.sp., *C. nimius* n.sp., *C. turneri* n.sp., and *C. wewalkai* n.sp. The species *C. congener* Omer-Cooper, 1956, is regarded as valid and not as a junior synonym of *C. canthydroides* (Régimbart, 1895). Lectotypes are designated for the following ten names: *C. alvei* Omer-Cooper, 1965, *C. consuetus* Omer-Cooper, 1965, *C. latus* Omer-Cooper, 1965, *C. lowryi* Omer-Cooper, 1965, *C. nebulosus* Omer-Cooper, 1965, *C. similator* Zimmermann, 1923, *C. simulator* Guignot, 1959, *C. testaceus* Zimmermann, 1923, *Hydroporus collaris* Boheman, 1848, and *Hydroporus hottentottus* Gemminger & Harold, 1868. A parsimony analysis based on 32 morphological characters found 28 shortest trees. Monophyly of the genus *Canthyporus* is supported mainly by the presence of an anterior ligula on the ventral side of the elytron. Four species groups are recognized within the genus: (1) *canthydroides* group, including ten species in Namibia and South Africa; (2) *exilis* group, including four species in Lesotho and South Africa; (3) *hottentottus* group, including 18 species from the Democratic Republic of the Congo, Ethiopia, Kenya, Lesotho, Madagascar, South Africa, Swaziland, Tanzania, and Zimbabwe; and (4) *lateralis* group, including three species from South Africa.

**Riassunto** - Revisione tassonomica del genere Afrotropicale *Canthyporus* (Coleoptera Dytiscidae).

Il genere *Canthyporus* Zimmermann, 1919 è revisionato. In totale sono riconosciute 35 specie, tutte sono distribuite nella regione Afrotropicale, con un centro di diversità nella Western Cape province (Sud Africa). Sono fornite le descrizioni di tutte le specie con illustrazioni dell'habitus, dei genitali maschili e femminili. Sono inoltre forniti una chiave per l'identificazione dei maschi delle specie, mappe di distribuzione e informazioni ecologiche. Sono descritte quattro nuove specie provenienti dal Sud Africa: *Canthyporus aenigmaticus* n.sp., *C. nimius* n.sp., *C. turneri* n.sp., and *C. wewalkai* n.sp. *Canthyporus congener* Omer-Cooper, 1956 è considerata come specie valida e non un sinonimo di *C. canthydroides* (Régimbart, 1895). Sono designati i lectotipi dei seguenti dieci taxa: *C. alvei* Omer-Cooper, 1965, *C. consuetus* Omer-Cooper, 1965, *C. latus* Omer-Cooper, 1965, *C. lowryi* Omer-Cooper, 1965, *C. nebulosus* Omer-Cooper, 1965, *C. similator* Zimmermann, 1923, *C. simulator* Guignot, 1959, *C. testaceus* Zimmermann, 1923, *Hydroporus collaris* Boheman, 1848 e *Hydroporus hottentottus* Gemminger & Harold, 1868. Un'analisi cladistica condotta secondo il criterio della parsimonia e basata su 32 caratteri morfologici ha prodotto 28 alberi. La monofilia del genere *Canthyporus* è supportata principalmente dalla presenza di un ligula anteriore sul lato ventrale dell'elitra. Sono riconosciuti quattro gruppi di specie all'interno del genere: (1) gruppo *canthydroides* che include 10 specie in Namibia e Sud Africa; (2) gruppo *exilis* che include 4 specie in Lesotho e Sud Africa; (3) gruppo *hottentottus* che include 18 specie provenienti dalla Repubblica Democratica del Congo, Etiopia, Kenya, Lesotho, Madagascar, Sud Africa, Swaziland, Tanzania e Zimbabwe; e (4) gruppo *lateralis* che include 3 specie del Sud Africa.

**Key words:** Coleoptera, Dytiscidae, revision, new species, phylogeny, Ethiopian Region.

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\* Contribution to the study of Dytiscidae 80.



## INTRODUCTION

The Hydroporinae, including about 2000 species world-wide, is the largest subfamily of the diving beetles in the family Dytiscidae (Nilsson, 2001). Within this subfamily, the tribe Hydroporini, with its ca. 600 species in 36 genera, is most diverse in the boreal and temperate regions of the Northern Hemisphere. In the Southern Hemisphere, this tribe is most diverse in the Australian Region, which has 11 endemic genera of Hydroporini (Nilsson, 2001). In South America, the tribe is only represented by the two species in the genus *Laccornellus* Roughley & Wolfe, 1987. The genus *Peschetius* Guignot, 1942, is chiefly African, but also includes two Oriental species (Biström & Nilsson, 2003). The only strictly Afrotropical genus of Hydroporini is *Canthyporus* Zimmermann, 1919, with 31 species, most of which are confined to South Africa (Omer-Cooper, 1965; Wewalka, 1981; Nilsson, 2001). The monophyly of Hydroporini is, however, not well supported (e.g. Miller, 2001), and it has been suggested that the genus *Canthyporus* has a more basal position within Hydroporinae than the rest of the Hydroporini (Wolfe, 1985; Roughley & Wolfe, 1987).

We here for the first time present a taxonomic revision of the entire genus *Canthyporus*. The taxonomy and the clarification of the phylogenetic relationships between the delimited units of the tribe Hydroporini are crucial tasks within Hydroporinae systematics.

With this study, we aim:

- A. To provide a complete taxonomic study of the genus *Canthyporus*, including diagnoses, illustrated descriptions, and distribution maps of all recognized taxa and a key for their determination.
- B. To undertake a cladistic analysis of the *Canthyporus* species to provide basis for intrageneric classification.

## MATERIAL AND METHODS

The material studied (in all 1704 specimens) comes from a number of museums, institutions, and private collections, referred to in the text by the following abbreviations:

- AMS, Albany Museum, Grahamstown, South America (coll. Omer-Cooper)
- BMNH, The Natural History Museum, London, UK
- CAS, California Academy of Sciences, San Francisco, CA, USA
- CBP, Coll. D. Bilton, Plymouth, UK
- CFB, Coll. H. Fery, Berlin, Germany
- CNU, Coll. A. N. Nilsson, Umeå, Sweden
- CRF, Coll. S. Rocchi, Firenze, Italy
- CTP, Coll. C. Turner, Plymouth, UK
- CTV, Coll. G. Wewalka, Vienna, Austria
- ISN, Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium
- LUZ, Zoologiska Museet, Lunds Universitet, Sweden
- MAC, Musée Royal de l'Afrique Centrale, Tervuren, Belgium
- MCG, Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy
- MCM, Museo Civico di Storia Naturale, Milano, Italy
- MNB, Museum für Naturkunde der Humboldt Universität, Berlin, Germany
- MNHN, Museum National d'Histoire Naturelle, Paris, France



MZH, Museum Zoologicum, Helsingfors, Finland

NMW, Naturhistorisches Museum, Vienna, Austria

RMS, Naturhistoriska Riksmuseet, Stockholm, Sweden

SAM, South African Museum, Cape Town, South Africa

TMP, Transvaal Museum, Pretoria, South Africa

USNM, Smithsonian Institution, Washington, DC, USA

ZFMB, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany

ZSM, Zoologische Staatssammlung, München, Germany

In the text, type material is generally given in full, whereas other material is cited to its informative part. Different labels are separated by a slash. The dissection technique and various other methods used are briefly described in Biström & Nilsson (2002). The positional terminology for male genitalia follows Miller & Nilsson (2003).

To reconstruct the phylogeny of *Canthyporus* and test the monophyly of the genus, a phylogenetic analysis was made, rooting the tree with *Laccornis oblongus* (Stephens, 1835) and *L. koca* (Ganglbauer, 1906). The genus *Laccornis* Gozis, 1914, is the sister group of all other Hydroporinae according to both Wolfe (1985, 1988) and a recent analysis by Miller (2001). We also included the Neotropical *Laccornellus lugubris* (Aubé, 1838) in the out-group, as this genus was suggested by Roughley & Wolfe (1987) to be the sister taxon of *Canthyporus*. Characters of female genitalia of *Laccornellus* were taken from illustrations provided by K. B. Miller. The parsimony analysis was based on the 32 informative characters within the matrix shown in tab. 1. All multistate characters except no. 23 were treated as additive. The tree search in the program NONA (Goloboff, 1995) used the following commands: hold\*; hold/100; mult\*100, with option amb- active. Trees were displayed and characters optimized on them in the software WINCLADA (Nixon, 2002). The two species *C. regimbarti* Nilsson, 2001, and *C. subparallelus* Guignot, 1956, were excluded from the parsimony analysis, as no information on their male genitalia was available.

#### HISTORICAL REVIEW OF THE TAXONOMY OF *CANTHYPORUS*

The earliest mention in the literature of *Canthyporus* species was Boheman's (1848) original description of *Hydroporus collaris*, *H. exilis*, and *H. lateralis*, based on specimens from South Africa. As the name *H. collaris* was preoccupied, Gemminger & Harold (1868) replaced it with *H. hottentottus*. Since Sharp (1882) never examined material of Boheman's three species, they were listed in Branden's (1885) catalogue with the comment 'gen. dub.' (indicating that Sharp did not fully accept their placement in *Hydroporus* Clairville, 1806). Sharp (1882) also added the new species *H. advena* from Cape Town, which he placed in his Group 9 of *Hydroporus*, together with species currently placed in *Laccornis* and *Laccornellus*. Régimbart (1895) described three additional species from the Cape Region, and synonymized Sharp's (1882) *H. advena* with *H. hottentottus*.

In Zimmermann's (1919, 1920) splitting of *Hydroporus*, the species from Sharp's Group 9 were placed in two new genera: *Agaporus* and *Canthyporus*. The latter originally including *C. bicintus*, *C. canthydroides*, *C. hottentottus*, *C. luridipennis*, and with some doubt also *C. exilis* and *C. lateralis*. Zimmermann (1920) also included *Hydroporus viticollis* Boheman, 1848, in *Canthyporus*, which was later transferred to Bidessini (now in



*Pseuduvarus* Biström, 1988). The name *Canthyporus* reflected the similarity in body shape to the noterid genus *Canthydrus* Sharp, 1882, observed by Zimmermann. Differences from *Agaporus* (now *Laccornis* and *Laccornellus*) emphasized by Zimmermann (1919) were the smaller size, the shorter and broader parameres, and the more marked posterior extension of the pronotum medially.

Two additional *Canthyporus* species from the Cape Region were described by Zimmermann (1923). The geographical range of the genus was expanded by Guignot, when he in 1936 described the new species *C. alpestris* from the Kilimandjaro, Tanzania, and later (Guignot, 1951b) *C. pauliani* from Madagascar. In the same year (Guignot, 1951a), three additional species from the Cape Region were described, including illustrations of male genitalia. Guignot (1946b) fixed *C. hottentottus* as the type species of the genus.

Omer-Cooper (1953, 1955) added two new species from the Cape Province, and provided the first examination of Boheman's types, resulting in the redescription of his *C. lateralis*. Five additional species were described by Omer-Cooper (1956), now expanding the range to Namibia and Swaziland. The same year, Guignot (1956) described *C. subparallelus* from the easternmost part of the Democratic Republic of the Congo.

Guignot (1959) provided descriptions and an identification key to the 14 species known by that time, still including also the bidessine *Pseuduvarus vitticollis* in the genus. Describing eight new *Canthyporus* species, Omer-Cooper's (1965) key included 23 species, now without *P. vitticollis*.

Three additional species from East Africa were described by Bilardo & Sanfilippo (1979; Kenya), Wewalka (1981; Ethiopia), and Nilsson (1991; Ethiopia). Wewalka (1981) reviewed the East African species and clarified the identity of the genus when transferring *Laccornis sigillatus* (Guignot, 1955) to *Canthyporus*.

Later, Roughley & Wolfe (1987) separated the two Neotropical species from the rest of *Laccornis*, placing them in the new genus *Laccornellus*. The phylogenetic analysis of Wolfe (1985, 1988) rejected a close relationship between *Laccornis* and *Canthyporus*. Roughley & Wolfe (1987) instead suggested that *Canthyporus* and *Laccornellus* were sister taxa. Later, Wolfe & Roughley (1990) erected the new monobasic tribe Laccornini for the genus *Laccornis*. Pederzani (1995), however, erroneously stated that this tribe originally also included *Canthyporus* and *Laccornellus*.

Nilsson (1991) suggested that selected characters from male genitalia may delimit clades within *Canthyporus*. This view gained some support from Mazzoldi (1997), who added several characters based on a detailed study of female genitalia.

Finally, Nilsson (2001) recognized 31 species in the Afrotropical genus *Canthyporus*, 25 of which have been described from South Africa and adjacent countries.

#### LIST OF CHARACTERS

The 32 morphological characters included in parsimony analysis are listed below. Distribution of character states among species is shown in tab. 1.

##### Body

1. Body shape: (0) elongate, (1) broad and flattened.
2. Body, lateral outline: (0) continuous, (1) constricted at level of pronotal base.



3. Body, dorsal colouration: (0) testaceous to brown, (1) almost totally black.

#### Head

4. Antenna, segments 4-10: (0) at least slightly longer than broad, (1) as long as or shorter than broad.

#### Prothorax

5. Pronotum, sublateral depression: (0) absent, (1) present.  
6. Pronotum, lateral part of posterior margin: (0) straight or indistinctly curved inwards, (1) strongly curved inwards.  
7. Prosternal process between procoxae (lateral aspect): (0) with distinct prominence, (1) with minute prominence, (2) smooth.  
8. Prosternal process, apex: (0) with lateral bead, (1) without lateral bead.

#### Pterothorax

9. Elytron, colour in basal part: (0) without distinct pattern, (1) dark brown with transverse testaceous spot.  
10. Elytron, shape of punctures: (0) circular, (1) somewhat extended longitudinally.  
11. Elytron, lateral bead: (0) partly visible from above, (1) totally visible from above.  
12. Elytron, apicolateral margin: (0) without bead, (1) with narrow bead.  
13. Elytron, ventrolateral carina in anterior half: (0) indistinct, (1) present, with ligula.  
14. Metasternum, longitudinal lines adjacent to midline: (0) absent, (1) fragmented, (2) continuous.

#### Legs

15. Male protarsal claws: (0) simple, (1) long and extended.  
16. Mesotarsus: (0) pseudotetramerous, (1) distinctly 5-segmented.  
17. Metacoxal lines: (0) subparallel, (1) anteriorly divergent.  
18. Metafemur, apical row of short spines: (0) absent, (1) present and discontinuous, (2) present and continuous.  
19. Male metafemur, medioposterior expansion: (0) absent, (1) present.  
20. Male metatibia: (0) almost straight, (1) distinctly curved.

#### Abdomen

21. Basal sternum: (0) broad, expands laterally, (1) narrow, median part parallel.

#### Genitalia

22. Penis, apical part in lateral aspect: (0) curved upwards, (1) substraight or curved downwards.  
23. Penis, dorsal process: (0) absent, (1) basal, (2) in distal half.  
24. Penis, dorsal process: (0) absent, (1) substraight, (2) curved to the left.  
25. Penis, dorsal process: (0) absent, (1) not strongly dilated (in dorsal view), (2) strongly dilated.  
26. Paramere, apex: (0) not incised, (1) incised.  
27. Paramere: (0) with no or sparse hairs, (1) with dense subapical hair tuft.  
28. Spermatheca, sclerotized part: (0) short and compact, (1) long and extended.  
29. Spermatheca, sclerotized part: (0) without distinct loop, (1) with loop.  
30. Spermatheca, sclerotization of tubuliform ductus: (0) continuous, (1) divided by a soft, almost transparent part.



31. Female laterotergite: (0) present, (1) absent.

32. Female gonocoxa, anterior apodeme: (0) absent, (1) present.

#### PHYLOGENY AND CLASSIFICATION

The search in NONA resulted in 28 shortest trees (length 97, CI 0.38, and RI 0.76), one of which is shown in fig. 1. All trees remained after applying the commando BEST in NONA, i.e. no trees included zero-length branches. The strict consensus tree is shown in fig. 2. Three synapomorphies contribute to the monophyly of *Canthyporus* relative to *Laccornellus*: (character 12) elytron with narrow bead along apicolateral margin, (character 13) elytron on ventral side with anterior ligula, and (character 18) metafemur with apical row of short spines.

The *Canthyporus* species form two major clades, each supported by a single character transformation. The first clade is referred here to as the South African *canthydroides* group. The second major clade is here separated into three species groups, viz. the *exilis*, *hottentottus*, and *lateralis* groups. As the basal clades are poorly supported and the majority of the characters are homoplastic, we have not recognized any subgenera, and instead distribute the species into less formal species groups. Each group is named after the oldest species included.

The unnamed species group suggested by Nilsson (1991), based on the shared presence of a ventral penis projection, corresponds to the *hottentottus* group, with the exception of *C. guttatus*. Nilsson (1991) also suggested a group including all species having apically incised parameres. This group corresponds best to the *canthydroides* group, although it also includes *C. guttatus* and *C. parvus*, both of which have parameres without this incision.

Mazzoldi's (1997) detailed study of female genitalia of nine South African *Canthyporus* species documented a certain correspondence with the characters of the male genitalia mentioned by Nilsson (1991). The basal separation between his five *canthydroides* group and four *hottentottus* group species in Mazzoldi's (1997) tree is congruent with our study. We were not able to treat female genital characters in the same detail as Mazzoldi (1997), as fresh material was unavailable for most of the species. It should also be noted that Mazzoldi (1997) misinterpreted the presence of accessorial lines on the metasternum (his character no. 7, our no. 14), as these lines are not present in the four *hottentottus* group species that he studied.

Wewalka (1981) later transferred *C. sigillatus* from its original position in *Laccornis*, its placement in *Canthyporus* was subject to doubt by Nilsson (1991). According to Mazzoldi (1997), the presence or absence in *C. sigillatus* of a spermatheca similar to his *petulans* group species would clarify this issue. As our study has confirmed the presence of this kind of spermathecal tract in *C. sigillatus*, the generic placement of this species should no longer be considered doubtful.



*Canthyporus* Zimmermann

TYPE SPECIES: *Hydroporus hottentottus* Gemminger & Harold, 1868, by subsequent designation of Guignot 1946b:115.

*Canthyporus* Zimmermann, 1919:147, 160 (orig. descr.), 1920:133 (list); Guignot, 1936:34 (disc.), 1951b:126 (disc., faun.), 1959:413 (descr.), 1961:928 (faun.); Omer-Cooper, 1962:293 (disc.), 1964:377 (descr., disc., faun.), 1965:145 (descr., faun.); Bertrand, 1963:436 (descr. larva), 1968:55 (faun., disc.), 1969:104 (faun.), 1970:36 (descr., faun.), 1972:54 (larvae); Bertrand & Legros, 1967:868 (faun.); Franciscolo, 1979:240 (faun.); Wewalka, 1981:57 (faun., disc., descr.); Wolfe, 1985:152 (disc., phylog.), 1988: 331, 334, 337, 340, 341, 342, 343 (disc., phylog.); Nilsson et al., 1989:292 (list); Nilsson, 1991:183 (faun., biol., disc, descr.), 2001:145 (cat.); Nilsson & Persson, 1993:59 (faun.); Pederzani, 1995: 39, 73 (disc., faun., descr., list); Mazzoldi, 1997:593 (disc., descr., faun.); Nilsson & Roughley, 1997:3 (list); Nilsson, 2001:145 (cat).

DIAGNOSIS. In Africa, South of the Sahara *Canthyporus* is distinguished from other Hydroporini by having non-keeled elytra, having metacoxal processes posteriorly clearly produced, and not having a delimited basal epipleural cavity.

Despite numerous studies, the phylogeny of Hydroporinae remains partly unknown. As a result of our analysis, we also can not demonstrate any unique synapomorphy to support the monophyly of *Canthyporus*. The minute bead located apically on each elytron (character 12 in the analysis) could, however, be a candidate for a unique character, although a detailed study of its distribution within Hydroporini is lacking. The anterior ligula on the ventral side of the elytron (character 13 in the analysis) is another potential synapomorphy of *Canthyporus*. The presence of a similar ligula in the bidessine genus *Bidessonotus* Régimbart, 1895, is seemingly homoplastic (Wolfe, 1985).

The presence of an apical row of short spines on the metafemur (character no. 18 in the analysis) is a third potential synapomorphy of *Canthyporus*. However, this character includes some variation that is difficult to observe, and a more detailed study including SEM photos of cleaned specimens is probably necessary for evaluation.

The genus *Canthyporus* has been included in studies on the phylogeny of basal lineages of Hydroporinae. Roughley & Wolfe (1987) discussed in their introduction of *Laccornellus* also *Canthyporus*, *Laccornis*, and the tribes Methlini and Hydrovatini and their intergeneric relationships. They identified a number of characters in common but did not consider any of them as a good synapomorphy for monophyly. Mazzoldi (1997) also could not demonstrate any reliable synapomorphy in his study of the female genitalia of *Canthyporus*. Finally, existing keys for determination of hydroporine genera do not give any useful clues of which characters might represent synapomorphies (Guignot, 1959; Omer-Cooper, 1965; Pederzani, 1995). The keys can, however, in most cases be used for separation of *Canthyporus* specimens from other Hydroporinae.

Our study has also yielded a number of characters that are seemingly unique for different sets of *Canthyporus* species, but since the distribution of these characters is incompletely known they could simply represent synapomorphies for different evolutive lineages distinguished. These characters are (1) metasternum adjacent to midline with a pair of longitudinal lines; (2) penis with a dorsal process of variable shape; (3) paramere apex incised in a peculiar manner.

DESCRIPTION. Body. Oval to oblong, sometimes elongated, and in part parallel-sided. A



few species have an enlarged and somewhat flattened body. One species has a fairly robust body. Elevation of the prosternal process is moderate compared with most other Hydroporini genera. Colour pattern variable, and in most species, quite diffuse and indistinct. A few totally pale or dark species exist as well. Small to medium-sized species (length 1.76-3.92 mm, width 0.86-2.32 mm). Punctuation and reticulation variable.

Head. Mid-frontally most species have two minute, sometimes hardly visible impressions. One species has an extensively depressed head frontally. Antenna variable and may roughly be divided into two main types: species with medial antennal segments longer than broad, and species with short medial segments (approximately as long as broad).

Pronotum. Colour pattern variable. Laterally beaded. Lateral outline almost straight to curved.

Elytra. Colour pattern variable. Elytral rows of punctures often discernible. In a few species, ordinary elytral punctures somewhat elongated.

Ventral aspect. In some species, metasternum adjacent to midline with longitudinal lines.

Sex. Males often with slightly enlarged pro- and mesotarsi. Penis variable, sometimes asymmetric. Spermathecal tract chitinized and well developed, often distinctly looped. Surface of spermatheca provided with minute, often hardly visible glands. Rarely, male metafemur provided with expansion. Male of one species with curved metatibiae.

DISTRIBUTION. Most species occur in southern Africa. The genus is also known from Madagascar and from some mountains in central and eastern Africa.

BIOLOGY. Often almost unknown. Notes on ecology and living habits given under each species.

#### KEY TO SPECIES OF *CANTHYPORUS* FOR MALES

The present key is only applicable to male specimens. A reliable identification in most species requires extraction of male genitalia. This is normally also the only dependable way to confirm sex of the specimens. The two species *C. regimbarti* and *C. subparallelus* are excluded because only the female is known. We refer to their diagnoses in the section in which separation of similar species is discussed.

1. Metasternum with an additional longitudinal line to each side of the midline (in one species, lines are fragmented) ..... 2
- Metasternum without longitudinal lines adjacent to midline ..... 11
2. Metasternum with adjacent longitudinal lines fragmented. Penis apex broad, apical outline rounded (fig. 45) ..... *C. testaceus* Zimmermann
- Metasternum with adjacent longitudinal lines distinct. Penis apex narrow ..... 3
3. Paramere apically not incised (fig. 42) ..... 4
- Paramere apically incised (e.g. fig. 6) ..... 5
4. Body length 3.64-3.92 mm; body blackish with distinct pale spots (fig. 19). Penis asymmetrical (fig. 20) ..... *C. guttatus* Omer-Cooper
- Body length 1.76-1.96 mm; body without distinct colour pattern (fig. 39). Penis symmetrical (fig. 40) ..... *C. parvus* Omer-Cooper
5. Body black, flattened, and broad (fig. 24). Penis apex truncate (fig. 25) ..... *C. latus* Omer-Cooper
- Body pale or with colour pattern, shape elongated. Penis apex not truncate ..... 6



6. Penis apex recurved ventrally (fig. 36) ..... 7
- Penis apex straight or recurved dorsally ..... 8
7. Penis narrows gradually towards apex (fig. 50) ..... *C. wewalkai* n.sp.
- Penis narrows abruptly towards apex (fig. 35) ..... *C. nimius* n.sp.
8. Elytral colour pattern distinct (fig. 29) ..... *C. navigator* Guignot
- Elytra pale or with indistinct colour pattern (figs 3, 8) ..... 9
9. Elytra pale, without colour pattern (fig. 14). Penis apex slender (fig. 15) ..... *C. guignoti* Omer-Cooper
- Elytra generally with discernible colour pattern. Penis apex broader (fig. 4) (*canthyroides* complex) ..... 10
10. Head uniformly pale (fig. 3). Elytral colour pattern reduced (fig. 3) ..... *C. canthyroides* (Régimbart)
- Head darkened posterior to eyes (fig. 8). Elytral colour pattern clearly discernible (fig. 8) ..... *C. congener* Omer-Cooper
11. Paramere apex with dense hair tuft (fig. 57) ..... 12
- Paramere apex glabrous or with small sparse hairs ..... 15
12. Body length 2.60 mm. Head with extensive anterior depression (fig. 62) ..... *C. aenigmaticus* n.sp.
- Body length 1.84-2.22 mm. Head without extensive anterior depression ..... 13
13. Penis narrows gradually towards apex (fig. 65) ..... *C. exilis* (Boheman)
- Penis narrows abruptly towards apex (fig. 72) (*nebulosus* complex) ..... 14
14. Body of more slender shape (fig. 54). Elytral rows of punctures more distinct ..... *C. brincki* Omer-Cooper
- Body of broader shape (fig. 68). Elytral rows of punctures fine, partly indistinct, or lacking .. *C. nebulosus* Omer-Cooper
15. Penis without dorsal process (fig. 161) ..... 16
- Penis with dorsal process (e.g. fig. 77) ..... 17
16. Penis apex slender and recurved ventrally (figs 165-166) ..... *C. lateralis* (Boheman)
- Penis apex dilated and not recurved ventrally (figs 160-161) ..... *C. bicinctus* (Régimbart)
17. Penis with dorsal process subapical (fig. 145) ..... *C. sigillatus* (Guignot)
- Penis with dorsal process subbasal to submedian ..... 18
18. Penis with dorsal process strongly expanded towards apex (fig. 85) ..... 19
- Penis with dorsal process slender or moderately expanded towards apex (e.g. fig. 76) ..... 21
19. Metatibia strongly curved (fig. 126) ..... *C. lowryi* Omer-Cooper
- Metatibia almost straight (fig. 88) ..... 20
20. Penis with dorsal process basally broad (fig. 102) ..... *C. fluviatilis* Omer-Cooper
- Penis with dorsal process basally slender (fig. 86) ..... *C. angustatus* Omer-Cooper
21. Penis apex bearing a ventral hook (fig. 109) ..... *C. hottentottus* (Gemminger & Harold)
- Penis apex without ventral hook ..... 22
22. Penis with dorsal process subbasal (fig. 152) ..... *C. swaziensis* Omer-Cooper
- Penis with dorsal process located closer to middle than to base (e.g. fig. 81) ..... 23
23. Penis with dorsal process located closer to apex of penis than to its base (e.g. fig. 157). Body uniformly dark ..... 24
- Penis with dorsal process submedian or located closer to its base (e.g. fig. 81). Body not uniformly dark ..... 25
24. Body subparallel (fig. 139). Penis with apex recurved ventrally (fig. 141). Paramere with apical outline substraight (fig. 142) ..... *C. planus* Omer-Cooper
- Body outline rounded (fig. 155). Penis apically not recurved (fig. 157). Paramere with apical outline curved (fig. 158) ..... *C. turneri* n.sp.



- 25. Penis with dorsal process in basal half subparallel to penis shaft (e.g. fig. 81)..... 26
- Penis with dorsal process in basal half at about a right angle to penis shaft (e.g. fig. 77)... 28
- 26. Penis with apex strongly recurved ventrally (fig. 91)..... *C. consuetus* Omer-Cooper
- Penis with apex moderately recurved ventrally (e.g. fig. 81)..... 27
- 27. Penis with apex pointed (fig. 80)..... *C. alvei* Omer-Cooper
- Penis with apex more rounded (fig. 95)..... *C. cooperae* Guignot
- 28. Penis with dorsal process apically recurved (e.g. fig. 123)..... 29
- Penis with dorsal process substraight, moderately curved from base to apex (e.g. fig. 77) ..31
- 29. Penis with small dorsal process (fig. 123)..... *C. loeffleri* Wewalka
- Penis with large dorsal process (e.g. fig. 114)..... 30
- 30. Penis apex moderately recurved (fig. 114)..... *C. hynesi* Nilsson
- Penis apex strongly recurved ventrally (fig. 118)..... *C. kenyensis* Bilardo & Sanfilippo
- 31. Penis apex slender, distinctly curved (fig. 136) ..... *C. petulans* Guignot
- Penis apex broader, substraight (e.g. fig. 77) ..... 32
- 32. Body length 2.32-2.56 mm. Antenna with medial segments longer than broad .....  
.....*C. alpestris* Guignot
- Body length 1.92-1.94 mm. Antenna with medial segments as long as broad.....  
.....*C. pauliani* Guignot

### Group *canthydroides*

This South African group includes ten species characterized by a metasternum with continuous longitudinal lines adjacent to midline (fragmented only in *C. testaceus*). Males of this group have a penis without dorsal projection (except in *C. guttatus*) and a paramere with an apical incision (except in *C. guttatus* and *C. parvus*). The female spermatheca is short, compact, and without a loop (except in *C. latus*).

#### *Canthyporus canthydroides* (Régimbart) (figs 3-7, 172)

*Hydroporus canthydroides* Régimbart, 1895:30 (orig. descr.).

*Canthyporus canthydroides* (Régimbart, 1895): Zimmermann, 1919:160 (n. comb.), 1920:133 (cat.), 1923:35 (disc.); Guignot, 1936:34 (disc.), 1959:419 (descr.); Omer-Cooper, 1953:31 (disc.), 1955:191 (disc.), 1956:304 (syn.), 1962:296 (faun.), 1965: 147 (syn., lectotype); Nilsson, 1991:187 (disc.), 2001:145 (cat.); Mazzoldi, 1997: 599 (descr. female).

*Canthyporus canthydroides* ab. *fuscus* Omer-Cooper, 1965: 147 (infrasubspecific).

*Canthyporus laccophiloides* Omer-Cooper, 1953:30 (orig. descr.): 1955:191 (disc.), 1962:296 (faun.).

*Canthyporus similator* Zimmermann, 1923:36 (orig. descr.): Omer-Cooper, 1953:31 (disc.), 1965:147 (disc.); Nilsson 2001:146 (cat.).

*Canthyporus simulator* Guignot, 1959:418 (unjust. emend.): Bertrand & Legros, 1967:867 (faun.).

TYPE LOCALITY. Of *canthydroides* South Africa, Western Cape, Cape Town environments; of *laccophiloides* South Africa, Western Cape, Cape Town, Lakeside; of *similator* and *simulator* South Africa, Western Cape, Cape of Good Hope.

TYPE MATERIAL. Lectotype ♂ of *canthydroides* deposited in SAM: “Capetown Peringuey/ male/ *canthydroides*/ Cotype”.

Holotype ♂ of *laccophiloides* deposited in BMNH: “Type male/Type/*Canthyporus laccophiloides* det. J. Omer-Cooper/Cape province, lakeside Cape Town 12.2. 1947 C. Harrison/Brit. Mus. 1956-157”. Paratype: same data as holotype, but labelled “Allotype female” (1 ex. AMS).



Lectotype ♂ of *similator* (and *simulator*) in ZSM, by present designation: “Type/De Vylder Cap b. sp./Samml. A. Zimmermann/Paratypes/Zool. Staatsslg. München”. Paralectotypes: same data as lectotype (1 ex. ZSM), but one specimen provided with a label “Typus” (1 ex. ZSM), and one, with three labels with loan numbers and a label “J. Balfour-Browne vid. 1955” (1 ex. RMS).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: “Tzizikama Foret Cape Prov./25.IX. 59 H. Bertrand/*C. canthydroides* Rég.” (1 ex. MNHN). WESTERN CAPE: “Capetown Peringuey/Museum Paris coll. Maurice Régimbart 1908” (3 exx. MNHN, ? type material); “Cape Flats ca 3-5 mls SE Philippi 5.VIII. 1954/grassy flood pools, Algae *Aponogeton* and *Hydrodictyon*/*C. canthydroides* Régb. J. Balfour-Browne det. -55” (3 exx. BMNH); “CPr. Cape Peninsula 3 mi NE Kommetjie 2.II. 51/*C. canthydroides* Rég. det. Omer-Cooper” (1 ex. LUZ); “Cap b. sp./*C. canthydroides* Régb. det. Zimmermann” (5 exx. RMS); “CPr Skurfteberg, Alfreds Berg Pass NNW Ceres 12.II. 51/*C. canthydroides* Rég. det. Omer-Cooper” (2 exx. LUZ); “CPr. Somerset West 29.XII. -91/marshy area near Firgrove/*C. canthydroides* Régb. det. Mazzoldi -92” (1 ex. CNU); SW Cape Nuweberg 10 km NE 34.00S-19.06E/13.XI. 73 shorewashing” (1 ex. MZH, 1 ex. TMP); same but “waterplankton” (1 ex. TMP). In all, 26 specimens studied.

DIAGNOSIS. See diagnosis of *C. congener* and also those of *C. guignoti*, *C. nimius*, and *C. wewalkai*.

DESCRIPTION. Body. Length 2.40-2.52 mm, width 1.24-1.32 mm. Ovally oblong. Colour pattern rather indistinct, moderately developed (fig. 3).

Head. Pale ferrugineous to ferrugineous, almost unicoloured. Frontal outline rounded; anteriorly in middle, two minute, transversely slightly extended punctures. Frontal depressions rather shallow but still clearly discernible. At inner margin of eyes, a row of punctures. Ordinary punctures fine, sparse to rather sparse, posteriorly denser than anteriorly. Slightly mat, finely reticulated. Antennal segments 1-4 pale ferrugineous, segments 5-11 somewhat enlarged, ferrugineous to dark ferrugineous.

Pronotum. Pale ferrugineous, medially with vague ferrugineous to dark ferrugineous marking, which may be absent or reduced. Lateral outline evenly curved; laterally with fine bead. Anteriorly and laterally, with rather fine punctures. Medial area with fine and sparse punctation. Finely microsculptured, slightly matt.

Elytra. Pale brown, laterally slightly paler. At suture and at pronotum, vague, narrow slightly darker area; elytral colour pattern vague. Discal row of punctures distinct, although slightly irregular; row disappears gradually in posterior half of elytron. Dorso-lateral and lateral rows of punctures somewhat indistinct and irregular. Ordinary punctures rather fine to fine, sparse, and partly irregularly distributed. Submat, finely microsculptured. Epipleuron pale ferrugineous, almost impunctate, finely reticulated.

Ventral aspect. Pale ferrugineous to ferrugineous. Apex of prosternal process moderately but still distinctly elevated; on different level than base of process. Prosternal process apex somewhat enlarged, laterally beaded, and medial area impunctate and only moderately keeled. Metacoxal plates with fine, sparse punctation; other parts of ventral aspect almost impunctate. Rather shiny, with fine, partly indistinct reticulation.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi moderately enlarged.

Male. Genitalia as in figs 4-6.

Female. Externally as male. Spermathecal tract as in fig. 7.

DISTRIBUTION. South Africa (Eastern Cape, Western Cape) (fig. 172).



BIOLOGY. Almost unknown. According to label information collected in flood pools with rich vegetation and in a marshy area.

*Canthyporus congener* Omer-Cooper (figs 8-13, 173)

*Canthyporus congener* Omer-Cooper, 1956:304 (orig. descr.).

*Canthyporus canthyroides* (Régimbart, 1895) (in part, misident.): Omer-Cooper, 1965:147 (syn.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Caledon.

TYPE MATERIAL. Holotype ♂ deposited in AMS: "Type/*Canthyporus congener* Det. J. Omer-Cooper/W Cape Province, stream in pine wood, Caledon 18.XI. 1947". Paratypes: 3 ♀ ♀ pinned together with holotype; "*C. congener* n.sp./Paratype/Storms River July 1946 J.G."

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: Principally with same data as holotype and labelled incorrectly as "Paratype" (3 exx. AMS; specimens are not mentioned in original description); Principally with same data as holotype (2 exx. AMS); "WCPr. Worcester 29.XI. 59" (1 ex. AMS); "WCPr W Milnerton 4.XII. 50" (1 ex. AMS); "WC, W Coast NP, lagoon S Langebaan Sept. 2002" (6 exx. CBP); "WCPr, sand vlei, Lake side Cape Town 22.VI. 47/*C. congener* ab. fuscus O-C." (22 exx. AMS); "Cape Flats c. 3.5 mls SE of Philippi 5.VIII. 1954/grassy flood pools, algae, *Aponogeton* and *Hydrodictyon*" (1 ex. BMNH); same but "In grassy evanescent vlei with Algae and *Isoetes*" (2 exx. BMNH); "CPr. Cape Flats, Varden Vlei 2 mi. E Ottery 2.II. 51/*C. congener* O-C. det. Omer-Cooper" (2 exx. LUZ); "Kalabaskraal ca. 350 ft 27.VII. 1954/roadside pond, much *Juncus* & *Nitella*" (2 exx. BMNH); "Rondebosch 6.VII. 1954/In brown acid water ephemeral pools" (1 ex. BMNH); "Concordia nr Knysna 17.III. 1954 *Scirpus* fringed vlei" (1 ex. BMNH); "Nr Wellington 300 ft 10.VIII. 1954/deep dam pool with grass and *Juncus* edging" (3 exx. BMNH); "Philadelphia 11.XI. 1949/*Canthyporus canthyroides* Rég. J. Balfour-Browne det. 1955" (1 ex. BMNH); "WCPr sandvlei, lakeside, Cape Town 23.XI. 1947/*C. congener* O-C. v. *fuscus* O-C. det. J.O.-C". (4 exx. MNHN); "W Cape W Coast NP: Abrahamskraal 33,13.9S-18,08E, 4.IV. 1998, water hole, *Typha* litter treated" (7 exx. MNB, 3 exx. MZH); "CPr. 20 km W Bredasdorp 5.I. 1994" (1 ex. CWV); "CPr. Somerset West 29.XII. -91/marshy area near Firgrove/*C. canthyroides* Rég. det. Mazzoldi - 92" (1 ex. CNU, 1 ex. CRF); "WC 2.IX. 2003, 330611S-182522E, pools, R45 E Hopefield, Turner, Mann, Reavell leg." (1 ex. CTP); CPr. Zekoevlei Fm 14 km S Bredasdorp Cape L'Aghulas 25.II. 1997 Turner leg." (4 exx. MZH, 100 exx. CTP); "WC, 8.IX. 2003, 34221S-202836E, alt. 134 m, ca. 10 km from De Hoop entrance on Malgas rd." (4 exx. CTP); "WC, 9.IX. 2003, 342723S-202619E, alt. 13 m, De Hoop Res., artificially maintained game pan" (5 exx. CTP); "WC, 9.IX. 2004, 342949S-202553E, alt. 17 m De Hoop Vlei, De Hoop Res." (3 exx. CTP); "WC, 30.VIII. 2003, 341436S-182306E, alt. 13 m, seasonal pool" (1 ex. CTP); – Additional specimens studied, but their determination considered slightly uncertain: "CPr. Wilderness NP Langvlei 33,59.0S-22,40,6E, 30.XI. 1996, malachite bird hide, *Juncus krausi* + bush litter sievings" (3 exx. MNB). Uncertain specimens are slightly smaller and have ordinary punctation somewhat finer and sparser than other examined material. In all, 191 specimens studied.

DIAGNOSIS. Very closely related to *C. canthyroides* from which *C. congener* is distinguished by the head, which posteriorly, particularly posteriorly to the eyes, is darkened. In addition, dark colour pattern of pronotum and elytra is more distinct in *C. congener*. Finally, penis apex (lateral aspect) is somewhat more strongly curved than in *C. canthyroides*. Pale specimens of *C. congener* are difficult to separate from *C. canthyroides*.

DESCRIPTION (only relevant differences from *C. canthyroides* given). Body. Length 2.32-2.80 mm, width 1.20-1.40 mm. Colour pattern with vague delimitation, but pale and dark



areas clearly discernible in most specimens (fig. 8).

Head. Posteriorly darkened, dark ferrugineous to brownish (fig. 8).

Pronotum. Medial dark marking generally fairly distinct.

Elytra. Colour pattern distinct, although their delimitation often gradual (fig. 8). Difference in punctures of discal row and ordinary punctation generally more pronounced.

Ventral aspect. On each side of metasternal midline, an additional line which disappears before reaching metasternal impression (at level of posterior part of mesocoxal cavity). Additional lines anteriorly not connected.

Male. Genitalia as in figs 9-11.

Female. Spermathecal tract as in figs 12-13.

DISTRIBUTION. South Africa (Western Cape) (fig. 173).

BIOLOGY. Almost unknown, except for label information; often collected in stagnant waters as pools, with growths of various plants (see under "Additional material studied" above). Also sampled from a marshy area and from a slightly saline, silt-bottomed waterbody. Turner collected the species from pools in field margins; fine silt with crops protruding. In addition, from a river just above an estuary with *Phragmites* and very muddy substrate with sparse vegetation, from a seasonal pool with fibrous vegetation, sedge, and with Proteacea surrounding the pool, and from a sandy farm reservoir.

TAXONOMIC NOTE. Earlier synonymization of *C. canthydroides* and *C. congener* is hereby with some hesitation rejected.

*Canthyporus guignoti* Omer-Cooper (figs 14-18, 174)

*Canthyporus guignoti* Omer-Cooper, 1956:306 (orig. descr.): 1962:296 (faun.), 1965:148 (descr.); Mazzoldi 1997:597 (descr. female); Nilsson 2001:146 (cat.).

TYPE LOCALITY. South Africa, Mpumalanga, Middleburg.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/Cape Province Middleburg, dam 22.2. 47 J. O.C./*C. guignoti* O-C.". Paratypes: principally same data as holotype (3 exx. AMS, 1 ex. BMNH); "E Cape Province Humansdorp Witte-Els-Bosch/13-2-1947 J. O-C./ male/ Paratype/ Paratype/ *Canthyporus guignoti* det. J. Omer-Cooper" (4 exx. AMS, 1 ex. MNHN).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "Karreedouv Pass Humansdorp/17.II. 47 (1 ex. MNHN); "ECPr, Humansdorp 15.V. 57" (1 ex. AMS). WESTERN CAPE: "C Pr. Theewaterskloof Dam 31.XII. 1991/stream nr Theewaterskloof Dam/*C. guignoti* O-C. det. Mazzoldi -92" (1 ex. CRF). In all, 13 specimens studied.

DIAGNOSIS. Very similar to *C. canthydroides*. The two species can be distinguished by studying elytral punctation, which is almost obliterated and hardly visible in *C. guignoti*, and fine but clearly discernible in *C. canthydroides*. Additionally, apex of penis is more curved (lateral aspect) in *C. guignoti* than in *C. canthydroides*.

DESCRIPTION (only relevant differences from *C. canthydroides* given). Body. Length 2.38-2.52 mm, width 1.20-1.30 mm. Dorsal aspect almost unicoloured, pale ferrugineous to ferrugineous, distinct colour pattern absent (fig. 14).

Elytra. Ordinary punctation fine to very fine, partly indistinct or lacking. Rather shiny, microsculpture indistinct.

Male. Genitalia as in figs 15-17.



Female. Externally as male. Spermathecal tract as in fig. 18.

DISTRIBUTION. South Africa (Eastern Cape, Mpumalanga, Western Cape) (fig. 174).

BIOLOGY. Almost unknown. According to label data collected in a stream.

*Canthyporus guttatus* Omer-Cooper (figs 19-23, 171)

*Canthyporus guttatus* Omer-Cooper, 1956:302 (orig. descr.): 1965:145 (descr.); Wewalka, 1981:57 (faun.); Curtis, 1991:185 (faun.); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. Namibia, Windhoek.

TYPE MATERIAL. Holotype ♂ deposited in AMS: "S.W. Africa Windhoek Town dam 7.7. 1937 J.O.C./ Type/ det. J. Omer-Cooper *Canthyporus guttatus* n.sp."

ADDITIONAL MATERIAL STUDIED. NAMIBIA: "Naukluft 1300-1500 m. 7-10.XII. 1933/*C. guttatus* O-C. J. Balfour-Browne det. 1957" (3 exx. BMNH); same but "*C. jordani* sp.n. J. Balfour-Browne det. 1955" (1 ex. RMS); Naukluft 5.XII. 1933 (4 exx. BMNH). In all, 9 specimens studied.

DIAGNOSIS. A distinct species, which is not easily confused with any other recognized *Canthyporus* species. *Canthyporus guttatus* is characterized by a peculiarly shaped penis (asymmetrical, robust, and dorsal process (lateral aspect) small in comparison with apex of penis) and by a large and black to dark ferrugineous body provided with distinctly delimited pale ferrugineous spots. All but one species are distinctly smaller (length at maximum 3.40 mm). The exception is *C. latus*, overlapping length of body (3.52-3.88 mm). The two species, however, deviate externally very much: *C. latus* has a unicoloured dark body without a distinct colour pattern. In addition the body of *C. latus* is enlarged and dorsoventrally distinctly flattened.

DESCRIPTION. Body. Length 3.64-3.92 mm, width 1.88-2.12 mm. Oval. Dorsal aspect with distinct colour pattern (fig. 19). Sometimes pale markings less distinct.

Head. Black to dark brown to brown. Frontal outline curved, medially slightly straighter. Frontal depressions shallow but clearly discernible. Finely and rather densely punctate. Frontal impressions absent. At inner margin of eyes, sparse, slightly coarser punctures. Submat, finely reticulated. Antenna of normal length, with elongated segments, pale ferrugineous to ferrugineous.

Pronotum. Black to dark ferrugineous, with distinct pale ferrugineous marking. Lateral outline curved, posteriorly almost straight. Finely and fairly densely punctate; punctation slightly irregularly distributed. Along margins, an irregular row of somewhat coarser punctures. Submat, finely reticulated.

Elytra. Black to dark ferrugineous, with fairly distinct pale ferrugineous markings (fig. 19). Very finely and densely punctate. At suture, a few hardly discernible punctures. Discal row of punctures forms longitudinal impressions; formed furrow interrupted by intervals. Dorsolateral row of punctures clearly discernible. Lateral row of punctures somewhat irregular. Rather shiny, finely reticulated. Epipleuron dark ferrugineous to dark brownish, indistinctly punctate, finely reticulated.

Ventral aspect. Blackish brown to dark ferrugineous. Prosternal process rather moderately elevated, apically distinctly enlarged. Medial surface of process convex. Metacoxal lines continue at midline on metasternum and form a loop between mesocoxae close to the metasternal cleft. Almost impunctate. Submat, covered with fine reticulation. Apical



sternite at apex with a wide depression.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 20-22.

Female. Apical sternite lacks apical depression. Spermathecal tract as in fig. 23.

DISTRIBUTION. Namibia (fig. 171).

BIOLOGY. Sampled at altitudes of 1300-1500 m a.s.l.

*Canthyporus latus* Omer-Cooper (figs 24-28, 175)

*Canthyporus latus* Omer-Cooper, 1965:148 (orig. descr.): Wewalka, 1981:57 (disc.); Mazzoldi, 1997:604 (descr. female); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Skurfteberg, Albert's Pass.

TYPE MATERIAL. Lectotype ♂ in LUZ, by present designation: "male type/S. Afr. Cape Prov. Skurfteberg, Alfreds Berg Pass. NNW Ceres 12.II. 1951 No. 181/ Swedish South Africa Expedition 1950-1951 Brinck-Rudebeck/ *Canthyporus latus* n.sp. Type male Det. J. Omer-Cooper/ Type no.1374:1-2 Dytiscidae Zool. Mus. Lund Sweden". Paralectotype: same data as lectotype, but labelled as "female type" (1 ex. LUZ).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: "S.W. Cape Hawaquas rad. tower 33.41S-19.06E/27.X. 1978: E-Y: 1484 shore washing/*C. latus* Omer-Cooper det. Biström 1995 (7 exx. MZH, 12 exx. TMP); "W Cape Bainskloof Pass 24.XII.-8.I. 2002, 33.38S-19.10E, waterfall, Grebennikov leg." (2 exx. MZH, 7 exx. NMW). In all, 30 specimens studied.

DIAGNOSIS. *Canthyporus latus* is a characteristic and well-delimited species, that cannot be confused with any other known species in the genus. Above all, it is characterized by a large, unicoloured blackish and dorsoventrally flattened body and by the appearance of male genitalia. See also diagnosis of *C. guttatus*.

DESCRIPTION. Body. Enlarged, flattened. Length 3.52-3.88 mm, width 2.20-2.32 mm. Almost entirely black to blackish ferrugineous; no colour pattern discernible (fig. 24).

Head. Black, anteriorly with a narrow blackish ferrugineous to ferrugineous area. Frontal outline between eyes curved. Medially, at frontal edge, a few minute punctures. Frontal depressions shallow but fairly extensive; their delimitation is vague. Punctuation very fine, somewhat sparse, in part indistinct. Submat, with distinct reticulation. At inner margin of eyes, a narrow and slight depression with dense punctures. Antenna rather slender (all segments longer than broad), black to dark ferrugineous, basal segment totally ferrugineous.

Pronotum. Black. Lateral outline almost straight to slightly curved; anteriorly, distinctly curved inwards. At margins, coarse punctures that are weaker at base of pronotum. Ordinary punctures dense and in general two size classes are distinguished: coarser punctures with diameter about 2-3 x that of finer punctures. Finer punctuation evenly distributed, while coarser punctures concentrated in medial part of pronotum. Submat, reticulation dense and distinct.

Elytra. Black. Rows of punctures absent. Ordinary punctuation dense, extensively but slightly irregularly distributed. Diameter of single puncture comparatively extensive, but depth moderate (shallow). Submat, reticulation distinct and dense. Epipleuron black to blackish ferrugineous, punctuation sparse and indistinct, submat, distinctly reticulated.



Ventral aspect. Black to blackish ferrugineous. Prosternal process moderately elevated, apex enlarged and with narrow lateral margins. Medial surface of apex almost flat, finely punctate. Apex located in a metasternal impression. Main part of ventral aspect with dense and fine to fairly fine punctation. Rather shiny, reticulation indistinct, hidden by dense punctation. Lines at metasternal midline distinct.

Legs. Blackish to dark ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 25-27.

Female. Externally as male or possibly the body slightly more matt than in male. Spermathecal tract as in fig. 28. No differences in appearance of protarsal claws or body size observed, despite indications in original description.

DISTRIBUTION. South Africa (Western Cape) (fig. 175).

BIOLOGY. Unknown.

*Canthyporus navigator* Guignot (figs 29-33, 172)

*Canthyporus navigator* Guignot, 1951a:23 (orig. descr.): 1959:422 (descr.); Omer-Cooper, 1962:296 (faun.), 1965:146 (faun.); Bertrand & Legros, 1967:867 (faun.); Mazzoldi, 1997:598 (descr. female); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Somerset West.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/ Skips Kop Pool Cape 4:7.46 T.G./ *Canthyporus navigator* Guign. Type, male/ F. Guignot det. 1950 *Canthyporus navigator* Guign. Type". Paratypes: "Isoetes Vlei Cape Flats/13:7:46 T.G./ male/ Paratype/ *Canthyporus navigator* Guign. Paratype male" (1 ex. MNHN); "Skips Kop pool Cape/4:7:46 T.G./ female/ Paratype/ *Canthyporus navigator* Guign. Paratype female" (1 ex. MNHN).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "CPr. Storms R. VII. 1946/C. *navigator* Guign. det. Omer-Cooper" (1 ex. AMS, 3 exx. MCG); "CPr. Tzitzikama Forest Storms River Mouth/C. *navigator* Guign. det. Omer-Cooper" (1 ex. LUZ). WESTERN CAPE: "C. Pr. Gordon's Bay/20.IX. 59 H. Bertrand/C. *navigator* Guign. C. Legros det." (7 exx. MNHN); "SW Cape Heunignes Riv. 34.42S-20.02E/28.X. 83 shorewashing" (1 ex. MZH, 1 ex. TMP); "WCPr sandvlei, Lake side, Cape Town 1947" (1 ex. AMS); "WCPr, small vlei nr C. Town 18.XI. 47" (3 exx. AMS); "WC 2.IX. 2003, 3418495S-182708E, alt 87 m Cape Point Res. Turner, Mann & Reawell leg." (2 exx. CTP, 1 ex. MZH); "WC, 30.VIII. 2003, 341436S-182306E, alt. 13 m, Groot Rondevlei, Cape Point Res., seasonal pool" (1 ex. CTP); "Capetown, C. Good Hope Res. 17.II. 1997 Turner leg." (4 exx. CTP, 1 ex. MZH); same but labelled "16.II. 1997" (4 exx. CTP); "W Cape, W Coast NP Abrahamskraal 33,13.9S-18,08E, 4.IV. 1998 waterhole, *Typha* litter treated (6 exx. MNB, 3 exx. MZH); "WC 2.IX. 2003, 331408S-18081E, Abrahams Kraal, W. Coast Nat. Park, alt. 50 m, Turner, Mann, Reavell leg" (1 ex. CTP); "WC, W Coast NP, lagoon S Langebaan Sept. 2002" (6 exx. CBP); "WC 10.IX. 2003, 342702S-201051E, rd Ouplas to Bredasdorp, Turner, Mann, Reavell leg." (1 ex. CTP); "WC 12.IX. 2003, 340949S-182558E, alt. 3 m, Glencairn Vlei Res." (2 exx. CTP); "WC, 9.IX. 2003, 342949S-202553E, alt. 17 m, De Hoop Vlei, De Hoop Res." (2 exx. CTP); "WC 9.IX. 2003, 342732S-205113, alt. 18 m, De Hoop Res., Turner, Mann Reavell leg." (3 exx. CTP); "WC 8.IX. 2003, 342211S-202836E, alt. 134 m, ca. 10 km De Hoop entrance on Malgas rd., sandy bottomed farm reservoir" (5 exx. CTP); "WC, 9.IX. 2003, 342723S-202619E, alt. 13 m, De Hoop Res., artificially maintained game pan" (25 exx. CTP); "WC, 12.IX. 2003, 341544S-182319E, pool in the fynbos along Olifantbos rd, Turner, Mann, Reavell leg." (2 exx. CTP); "CPr. Zekoevlei Fm 14 km S Bredasdorp, Cape L'Aghulas Turner leg." (5 exx. CTP); "CP Plettenberg Bay 14.III. 68" (1 ex. USNM);



“CPr. Wilderness 2.XII. 1947” (1 ex. AMS); “CPr, Klein River lagoon, Hermanus 1.V. 47” (2 exx. AMS); “Somerset West 28-29.XII. 1991/marshy area nr Firgrove/*C. navigator* Guign. det. Mazzoldi -92” (1 ex. CRF); “Somerset West 25.I. 41” (1 ex. AMS); “Ratel R. 30.VII. 46” (2 exx. AMS). In all, 103 specimens studied.

**DIAGNOSIS.** *Canthyporus navigator* is a distinct and well-delimited species, easily distinguished from other known species of the genus. From closely related species, *C. navigator* is separated by its large size, the body's distinct colour pattern, and the shape of the penis.

**DESCRIPTION.** Body. Length 2.72-3.08 mm, width 1.48-1.60 mm. Ovals oblong, dorsoventrally slightly flattened. Dorsal appearance as in fig. 29.

Head. Blackish ferrugineous to dark ferrugineous. Frontal depressions clearly discernible, although moderately deep. Frontal outline of head medially almost straight. Frontally, in middle, two very indistinct, transverse punctures. Punctuation very fine, sparse, partly absent. Discally separate punctures still clearly discernible. Rather shiny, although finely reticulated (meshes clearly discernible). Antenna quite slender; segments 1-4 pale ferrugineous to ferrugineous, apical segments at least partly darker; dark ferrugineous.

Pronotum. Pale ferrugineous; at anterior margin and posteriorly in middle, darkened and black to dark ferrugineous. Anterior and posterior, dark areas medially connected by a broad dark marking (fig. 29). Lateral outline almost straight, anteriorly slightly curved inwards. Punctures irregularly distributed. At margins and medially, punctures slightly coarser, discally on each side sparse and very fine. Rather shiny, although finely reticulated. Medially with narrow area lacking reticulation.

Elytra. Blackish brown to brownish, with vague paler areas (fig. 29). Punctures rather fine, somewhat sparse and somewhat irregularly distributed. Rows of punctures indistinct, hardly discernible. Rather shiny, although finely to very finely reticulated. Epipleuron pale ferrugineous to ferrugineous, sparsely punctate, rather shiny and finely microsculptured.

Ventral aspect. Dark brown to dark ferrugineous, thorax partly paler, ferrugineous. Apex of prothorax enlarges posteriorly, ventral surface almost flat, laterally finely beaded. At lateral margins, punctures; medially, impunctate. Prosternal process starts anteriorly from an extensive depression close to/anterior to procoxa. Punctures fine to rather fine, sparse to fairly dense, and irregularly distributed (partly absent or very fine). Rather shiny, partly with distinct reticulation.

Legs. Pale ferrugineous to ferrugineous.

Male. Pro- and mesotarsi slightly enlarged. Genitalia as in figs 30-32.

Female. Pro- and mesotarsi slightly narrower. Spermathecal tract as in fig. 33.

**DISTRIBUTION.** South Africa (Eastern Cape, Western Cape) (fig. 172).

**BIOLOGY.** Once collected in a waterhole. Turner et al. collected specimens in a deep reservoir, the margins well vegetated with grass, sedge, and reed. Turner also sampled the species in a permanent pond with inflowing seep, good emergent vegetation, and grassy margins, and from a slightly saline waterbody with a silty bottom. Also from a sandy roadside reservoir with some vegetation and from open pools surrounded by reeds on sandy substrate, and from a river above the estuary with *Phragmites* and a very muddy sparsely vegetated substrate. Finally, it has been sampled in a temporary pool with trickle draining and



abundant fynbos debris, a seasonal pool with fibrous vegetation, sedge, and Proteacea surrounding the pool, and a farm reservoir with a sandy bottom.

*Canthyporus nimius* n. sp. (figs 34-38, 176)

*Canthyporus canthyroides* (Régimbart, 1895) (misident.): Omer-Cooper, 1956:304 (descr.).

TYPE LOCALITY. South Africa, Eastern Cape, Witte Elbosch, Groot River.

TYPE MATERIAL. Holotype ♂ in BMNH: "Stn. No. 78/S. Africa Witte Elbosch Groot River, 19.iii. 1954/ Rapid stream, weed & moss, dead edges/ J. Balfour-Browne Brit. Mus. 1954-797/ *Canthyporus simulator* O.C. nec Zimm. J. Balfour-Browne det., II. 1970". Paratypes: same data as holotype (3 exx. BMNH, 1 ex. MZH); "Stn. No. 84/S. Africa E. Cape Province Van Staaden's Pass 21.III. 1954/ In gravel at edge of fast stream/ J. Balfour-Browne Brit. Mus. 1954-797/ *Canthyporus* J. Balfour-Browne det. XI. 1955 (1 ex. BMNH); "Witte Els Bosch/ Humansdorp 14:II. 47 J.O.C./ *Canthyporus simulator* Zimm." (1 ex. MNHN); same data but "13:2:47" (5 exx. AMS); "Humansdorp, muddy pond 3.9. 1955 J.O.C." (1 ex. AMS); "E Cape Province Humansdorp (? not readable) pond 2.I. 1956 J.O.C." (2 exx. AMS); "E Cape Province Humansdorp dist. Pool, Witte Als Bosch 3.9. 1955" (1 ex. AMS); "*C. simulator* Zimm. E Cape Province Humansdorp 19.I. 1958" (1 ex. AMS and 1 ex. AMS, not labelled as paratype because of bad condition); "E Cape province Humansdorp dist., stream (? Unreadable) to Humansdorp rd. 6.9. 1948" (3 exx. AMS); "South Africa Plettenberg Bay C.P. III-14-68 Paul J. Spangler" (3 exx. USNM, 1 ex. MZH).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA, EASTERN CAPE: "Storms River July 1946 J.O.C." (1 ♀ AMS). Not labelled as a paratype because of uncertain determination. In all, 26 specimens studied.

ETYMOLOGY. The new species described is one of a multitude of similar species and can therefore be regarded as superfluous (= nimius in Latin).

DIAGNOSIS. Very similar to *C. canthyroides* and *C. guignoti*. For separation of the three species, male genitalia must be examined: *C. nimius* has an extreme penis apex, in lateral view, distinctly curved upwards, while the corresponding feature in the two other species is straight.

DESCRIPTION (only relevant differences from *C. canthyroides* given). Body. Length 2.30-2.68 mm, width 1.18-1.40 mm. Dorsal aspect of body as in fig. 34.

Pronotum and elytra. General punctation very fine and hardly visible; density slightly variable. Rows of punctures finer.

Ventral aspect. Metasternum at midline with additional lines; formed almost as continuation of metacoxal lines.

Male. Genitalia as in figs 35-37.

Female. Externally as male. Spermathecal tract as in fig. 38.

DISTRIBUTION. South Africa (Eastern Cape, Western Cape) (fig. 176).

BIOLOGY. Most probably in or close to running waters. The species has been collected from a rapid stream with weed and moss, and in gravel at the edge of a fast stream. Also sampled from standing water in pools and ponds.

*Canthyporus parvus* Omer-Cooper (figs 39-43, 177)

*Canthyporus parvus* Omer-Cooper, 1955:190 (orig. descr.): 1962:296 (faun.); Bertrand & Legros, 1971:249 (faun.); Nilsson, 2001:146 (cat.).



TYPE LOCALITY. South Africa, Western Cape, Caledon.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/Cape, stream in pine wood, Caledon 18.XI. 1947/typus/*C. parvus* n.sp. det. J. Omer-Cooper/Brit. Mus. 1956-157". Paratype: mounted on separate card but pinned together with holotype; accordingly with similar label data (1 ♀ BMNH).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: Principally with same data as holotype, but not mentioned in original description (3 exx. AMS); "Schusters Kraal 7 mi. S Simonstown 400 ft, 30.VII. 1954/shallow grassy pool, ephemeral" (6 exx. BMNH); "Cape Flats ca. 3-5 mls. SE of Philippi, 5.VIII. 1954/grassy flood pools, Algae, *Aponogeton* and *Hydrodictyon*/*C. parvus* O-C. det. J. Balfour-Browne det. XI. 1955" (1 ex. BMNH); "Near Kommetje 200 ft. 30.VII. 1954/in running stream with *Glyceria* sp./*C. parvus* O-C. det. J. Balfour-Browne det. IV. 1962" (1 ex. BMNH); "Sir Lowry Pass, Steenbras Forest 1.500 ft, 9.III. 1954/In swampy brown water pool/*C. parvus* O-C. det. J. Balfour-Browne det. IV. 1963" (1 ex. BMNH); "CPr. Cape of Good Hope 8.I. 1949" (9 exx. CWV, 2 exx. MZH); Capetown, C. Good Hope Res. 17.II. 1997 Turner leg (1 ex. MZH, 2 exx. CTP); same data but "16.II. 1997" (3 exx. CTP); WC 30.VIII. 2003, 341436S-182306E, alt. 13 m, Groot Rondevlei, Cape Point. Res., seasonal pool" (2 exx. CTP). In all, 33 specimens studied.

DIAGNOSIS. A distinct species characterized by the following features: body small and elongate, ordinary elytral punctation with longitudinally extended punctures, and penis symmetrical, lacks dorsal process, and narrows gradually towards apex.

DESCRIPTION. Body. Length 1.76-1.96 mm, width 0.86-0.92 mm. Elongate, lateral outline slightly curved. Almost unicoloured, pale ferrugineous to ferrugineous. Colour pattern indistinct (fig. 39).

Head. Pale ferrugineous, frontally slightly paler. Frontal outline curved, medially outline becomes slightly straighter. With minute, hardly visible, frontomedial impressions. Frontal depressions vague but still clearly discernible. Punctation indistinct, scattered; fine punctures may be discerned among distinct reticulation, which completely covers the total upper aspect of the head. At inner margin of eyes, rather indistinct, sparse punctures. Antenna pale ferrugineous to ferrugineous, quite short, segments 4-10 approximately as broad as long.

Pronotum. Pale ferrugineous to ferrugineous, lateral outline slightly curved but posteriorly very weakly so. At margins, fine punctures; discally, punctation sparser and irregularly distributed.

Elytra. Pale ferrugineous to ferrugineous, with indistinct darker marking on disc (fig. 39). With rather fine and somewhat irregular and sparse punctation, which is laterally distinctly weaker. Each puncture longitudinally slightly extended. Rows of punctures indistinct; laterally, an irregular row of punctures may be discerned. Rather shiny, although covered with distinct reticulation. Epipleuron pale ferrugineous, punctation indistinct, finely microsculptured.

Ventral aspect. Pale ferrugineous to ferrugineous. Prosternal process moderately elevated with apex somewhat enlarged, laterally margined. Punctation scattered and sparse, on large areas absent. Shiny, reticulation discernible on metacoxal plates and abdomen. Metacoxal lines continue on metasternum and almost reach a well-developed metasternal cleft between mesocoxae.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi somewhat enlarged.



Male. Genitalia as in figs 40-42.

Female. Spermathecal tract as in fig. 43. According to original description, female head slightly narrower and head and pronotum somewhat more coarsely punctured. These external differences were not validated in our study.

DISTRIBUTION. South Africa (Western Cape) (fig. 177).

BIOLOGY. Collected from grassy pools and at least once from a swampy brown water pool. Also collected in a stream with *Glyceria* sp. Sampled by Turner in a permanent pond fed by seepage, with emergent vegetation and grassy margins. In addition, from a seasonal pool with fibrous vegetation and sedge with Proteacea surrounding the pool.

*Canthyporus testaceus* Zimmermann (figs 44-48, 178)

*Canthyporus testaceus* Zimmermann, 1923:35 (orig. descr.): Omer-Cooper, 1956:307, 1962:293, (faun.), 1965:156 (faun.); Guignot, 1959:417 (descr.); Mazzoldi, 1997:600 (descr. female); Nilsson, 2001:147 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Cape of Good Hope.

TYPE MATERIAL. Lectotype ♂ in ZSM, by present designation: "Type/De Vylder Cap. b. sp./Samml. A. Zimmermann/Paratypus/Zool. Staatsslg. München". Paralectotypes: same data as lectotype, but labelled as "Typus" (1 ex. ZSM); same data as lectotype but provided with additional loan labels of the depository collection (3 exx. RMS).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "Cape Storms Riv. VII. 46" (2 exx. AMS). WESTERN CAPE: "Simonstown 12-20.IV. 1915/*C. testaceus* Zimmermann J. Balfour-Browne det. 1954" (4 exx. BMNH); "Cape Flats ca 3-5 mls SE Philippi 5.VIII. 1954/Grassy flood pools, Algae, *Aponogeton*, *Hydrodictyon*/*C. testaceus* Zimmermann J. Balfour-Browne det. 1963" (1 ex. BMNH); "CPr. Princess Vlei, Lake side nr. Cape town 8.IV. 46" (1 ex. AMS); "WCPr. Princess Vlei, Cape Town 23.VI. 47" (1 ex. AMS); "WCPr. Princess Vlei, Cape Town 23.VI. Sir Lowry Pass Steenbras Forest 1500 ft. 9.III. 1954/ In swampy brown water pool/ *C. testaceus* Zimmermann J. Balfour-Browne det. 1963" (1 ex. BMNH); "Capl. süßwasser Tümpel b. Chapmansbay 8.VII. 1903" (1 ex. MNB); "CPr. Cape Peninsula Vlej 3 mi NE Kommetjie 2.II. 51/*C. testaceus* Zimm. Det. Omer-Cooper" (1 ex. LUZ); "CPr. Zekoevlei Fm 14 km S Bredasdorp, 25.II. 1997 Turner leg., river above estuary" (1 ex. CTP); "WC 8.IX. 2003, 342211S-202836E, alt. 134 m, ca. 10 km from De Hoop entrance on Malgas rd." (1 ex. CTP); "C Pr. Cape Agulhas 1.I. 1992/ Soetendalsvlei marsh/ *C. testaceus* Zimm. Det. Mazzoldi -93" (2 exx. CRF); "Mare (?) Worcester Robertson 14.IX. 59/*C. testaceus* Régb. (!) Legros det." (1 ex. MNHN); "Skipskop pool Cape/4.I. 1946" (1 ex. MNHN); same but "4.VII. 1946" (2 exx. AMS); SW Cape Nuweberg 10 km NE 34.00S-19.06E/13.XI. 73 shorewashing, dam" (1 ex. TMP); same but "waterplankton" (1 ex. TMP). In all, 27 specimens examined.

DIAGNOSIS. A distinct species which can, however, be overlooked if only external features are examined. Externally, it resembles *C. canthydroides*, *C. congener*, and some other similar species but is separated from them by the apex of the penis being obtuse instead of pointed in the ventral aspect. Moreover, *C. testaceus* has only rudimentary adjacent lines at the midline of the metasternum in the posterior part.

DESCRIPTION (only relevant differences from *C. canthydroides* given). Body. Length 2.64-3.00 mm, width 1.36-1.52 mm. Dorsal aspect with minute darker areas, otherwise pale (fig. 44).

Head. Punctuation fine to very fine. Antenna with segments 5-11 only slightly darker than basal segments.



Pronotum. At base, a narrow, vague, dark ferrugineous area. Discal punctation very fine. Elytra. Ordinary punctation very fine, partly indistinct.

Ventral aspect. Metasternum and metacoxal plates partly dark ferrugineous. Apex of prosternal process almost flat. Metacoxal plates in part with distinct punctures. Metasternum lacks distinct lines at midline; continuation of metacoxal lines only discernible posteriorly as rudimentary lines.

Male. Genitalia as in figs 45-47.

Female. Externally as male. Spermathecal tract, bursa copulatrix, and gonocoxae as in fig. 48.

DISTRIBUTION. South Africa (Eastern Cape, Western Cape) (fig. 178).

BIOLOGY. Almost unknown. Collecting labels refer to pools with vegetation and a swampy pool with brown water. Turner collected the species in a river above the estuary with *Phragmites* and very muddy substrate but little aquatic vegetation, and from a farm reservoir with sandy bottom.

***Canthyporus wewalkai* n. sp. (fig 49-53, 178)**

TYPE LOCALITY. South Africa, Western Cape, Kalabaskraal.

TYPE MATERIAL. Holotype ♂ in BMNH: "Stn. 326/ S. Africa Kalabaskraal ca. 350 ft. 27.VII. 1954 J. Balfour-Browne/ Roadside pond, much *Juncus* and *Nitella*/ J. Balfour-Browne Brit. Mus. 1954-792/ *Canthyporus* sp.n. J. Balfour-Browne det. II. 1970". Paratypes: same as holotype (3 exx. BMNH, 1 ex. MZH); "Stn. No. 355/S. Africa near Wellington 300 ft. 10.VIII. 1954 J. Balfour-Browne/Deep dam pool with grass and *Juncus* edging/ J. Balfour-Browne Brit. Mus. 1954-797" (1 ex. BMNH, 1 ex. MZH); "Stn. 354/ S.Africa near Wellington 300 ft. 10.VIII. 1954 J. Balfour-Browne/ Muddy shallow pool, grit bottom with *Typha*/ J. Balfour-Browne Brit. Mus. 1954-797" (1 ex. BMNH); "Stn. No. 13/S. Africa Cape province Stellenbosch district/ Cape Province, Fransch Hoek, Great Berg River 4.III. 1954/ near Lategan, side pool in grasses/ J. Balfour-Browne Brit. Mus. 1954-797" (1 ex. BMNH); Südafrika 6.1. 1994 Cape Province 10 km E Hermanus leg. Wewalka (18)/ *Canthyporus* Nr. 2 sp. Det. Wewalka 94" (1 ex. CWV). In all, 10 specimens studied.

ETYMOLOGY. Named after Professor Günther Wewalka, Vienna, who had first recognized this new species.

DIAGNOSIS. *Canthyporus wewalkai* can be separated from closely related species only by examination of the penis: in ventral view, the penis narrows gradually towards a pointed apex; in lateral view, the penis apex narrows and curves slightly upwards.

DESCRIPTION (only relevant differences from *C. canthydroides* given). Body. Length 2.30-2.40 mm, width 1.18-1.22 mm. Colour pattern modest (fig. 49).

Head. Antenna with segments 5-11 darkened, rarely partly blackish brown.

Elytra. Ordinary punctation very fine and slightly denser than in *C. canthydroides*. Punctures of discal row fine; only slightly coarser than adjacent, ordinary punctation.

Male. Genitalia as in figs 50-52.

Female. Externally as male. Spermathecal tract as in fig. 53.

DISTRIBUTION. South Africa (Western Cape) (fig. 178).

BIOLOGY. Obviously, a stagnant water species, living in pools and dams with various vegetation, e.g. *Typha* and *Juncus*.



Group *exilis*

This group includes four South African species sharing a comparatively small but broad, flattened body. The medial segments of antenna are as long as broad. The paramere has a dense apical hair tuft. Moreover, the mesotarsus is distinctly five-segmented, and the penis lacks the dorsal projection. The female spermatheca is short, compact, and without a loop (unknown in two of the species).

*Canthyporus brincki* Omer-Cooper (figs 54-57, 174)

*Canthyporus brincki* Omer-Cooper, 1965:158 (orig. descr.): Nilsson, 2001:145 (cat.; Botswana in error).

TYPE LOCALITY. Lesotho, Quthing.

TYPE MATERIAL. Holotype ♂ deposited in LUZ: "Type/S. Afr. Basutoland Quithing 15.III. 51 No. 234/Swedish South Africa Expedition 1950-1951 Brinck-Rudebeck/*Canthyporus brincki* O.-C. J. Omer-Cooper/Zool. Mus. Lund Sweden Type No. 1375:1 Dytiscidae". In all, one specimen studied.

DIAGNOSIS. The penis apex of *C. brincki* and *C. nebulosus* narrows abruptly. Separation of *C. brincki* and *C. nebulosus* is difficult because male genitalia seem to be identical. According to the original description of the two species (Omer-Cooper, 1965), *C. brincki* should be distinguishable by its oblong body-shape and by its more evident second serial row on the elytron. Moreover, in the key given in the same publication, the two species are distinguished by the sutural row formed by a few widely spaced punctures in *C. brincki*, while *C. nebulosus* is stated to lack a clear sutural row of punctures. We cannot confirm this, and accordingly, the existence of two separate species is considered doubtful and in need of further studies.

DESCRIPTION OF MALE. Body. Length 2.06 mm, width 1.12 mm. Ferrugineous to pale ferrugineous, dorsal colour pattern rather vague (fig. 54).

Head. Pale ferrugineous to ferrugineous, posteriorly slightly darker than anteriorly. Frontal outline rounded. Frontomedial impression almost absent; a single, minute impression may be interpreted as a homologous feature. Frontal depressions vague and hardly visible. Almost impunctate, a few scattered, minute punctures may be discerned. Rather shiny, although with fairly distinct reticulation. At inner margin of eyes, indistinct punctures (homologous feature with row of punctures?). Antenna pale ferrugineous, rather short, segments 4-10 rectangular, as long as broad.

Pronotum. Ferrugineous, laterally with broad pale ferrugineous areas. Lateral outline curved. At margins, rather coarse but sparse punctures. Ordinary punctation hardly visible, almost lacking. Rather shiny, although fairly distinctly reticulated.

Elytra. Pale brown, with brownish to ferrugineous, vague markings (fig. 54). Discal row of punctures distinct, posteriorly somewhat irregular. Dorsolateral and lateral rows consist of scattered punctures, which form an irregular row. Sutural row almost absent, punctures indistinct. Ordinary punctures very fine, somewhat sparse. Submat, with distinct reticulation. Epipleuron pale ferrugineous, impunctate, finely reticulated.

Ventral aspect. Dark ferrugineous to ferrugineous, prothorax partly paler. Prosternal process moderately elevated; apex enlarged, laterally margined, and medial surface slightly convex and sparsely and finely punctate. Apex of process located in a metastern-



nal impression between mesocoxae. Punctuation almost absent. Finely reticulated and slightly mat, except metasternum, shiny, reticulation reduced. Metacoxal lines do not continue on metasternum.

Legs. Pale ferrugineous to ferrugineous.

Male. Genitalia as in figs 55-57.

Female. Unknown.

DISTRIBUTION: Lesotho (Quthing) (fig. 174).

BIOLOGY: Unknown.

*Canthyporus aenigmaticus* n. sp. (figs 58-62, 176)

TYPE LOCALITY. South Africa, Western Cape, Cedarberg.

TYPE MATERIAL. Holotype ♂ in TMP: "S.Afr., Cape-Cedarbg, jeeptrack 900 m, 32.28S-19.15E/8.11. 1983, E-Y: 2056, water pools leg. Endrödy-Younga". In all, one specimen studied.

ETYMOLOGY. The new species exhibits many peculiar structures and can therefore be considered an enigmatic species.

DIAGNOSIS. Shape of male genitalia and habitus locate the new species in the *C. exilis* group. The new species is distinctly larger than the three other species of the group. In addition, its head is frontally depressed slightly posterior to the anterior margin (almost beaded). The shape of the penis is also peculiar to *C. aenigmaticus*, separating it from closely related species.

DESCRIPTION OF MALE. Body. Length 2.60 mm, width 1.44 mm. Almost oval. Elytral colour pattern rather obscure; elytra with somewhat vague darker spots (fig. 58).

Head. Blackish ferrugineous to dark ferrugineous, frontally with vague pale ferrugineous area. With a slight depression close to the anterior head margin (fig. 62). Frontal depressions vague. Punctuation very fine, rather sparse, and hardly discernible. At inner side of eye, a few coarser punctures. Submat, distinctly microreticulated. Antenna short and stout (fig. 62).

Pronotum. Blackish to dark ferrugineous, with pale ferrugineous areas located laterally and frontally. Lateral outline slightly curved. Along margins, an irregular and partly sparse row of punctures. Ordinary punctuation rather unclear because of distinct reticulation. Rather shiny.

Elytra. Yellowish, with vague, irregular, dark brown spots (fig. 58). Sutural row of punctures discernible, but sparse. Discal, dorsolateral, and lateral rows of punctures discernible but sparse, and particularly in the dorsolateral and lateral rows, also irregular, not forming distinct rows. Ordinary punctures absent. Submat, distinctly reticulated. Epipleuron yellowish, reticulated, impunctate.

Ventral aspect. Black, abdomen apically slightly paler, and prothorax partly ferrugineous to pale ferrugineous. Prosternal process slightly elevated. Apex of process somewhat enlarged, laterally beaded, medial surface slightly convex and impunctate. Apex located in well-developed impression of metasternum. Additional lines at midline of metasternum absent. Finely and densely punctate, but punctures partly obliterated. Rather shiny, reticulation fragmentary. Metacoxal plates close to base of hind legs at metacoxal lines with slight depressions formed and delimited as if to locate metatrochanters in extreme forward position.



Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi slightly enlarged. Last segment of mesotarsus extended and longer than last segment of protarsus.

Male. Genitalia as in figs 59-61.

Female. Unknown.

DISTRIBUTION. South Africa (Western Cape) (fig. 176).

BIOLOGY. Unknown. Holotype collected from water pools.

*Canthyporus exilis* (Boheman) (figs 63-67, 177)

*Hydroporus exilis* Boheman, 1848:257 (orig. descr.): Sharp, 1882:795 (descr.); Branden, 1885:53 (cat.); Zimmermann, 1919:160 (list, ?*Canthyporus*).

*Canthyporus exilis* (Boheman, 1848): Zimmermann, 1920:134 (n. comb.); Guignot, 1951b:126 (disc.), 1959:415 (descr.); Omer-Cooper, 1955:191 (disc.), 1962:294 (faun.), 1965:157 (descr.); Wewalka, 1981:58 (disc.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, "Caffraria interiore".

TYPE MATERIAL. Single syntype known in RMS lost, only pin with information labels preserved: "J. Wahlb./ Type/Caffraria/Typus/*Hydroporus exilis* Boh./124 54/J. Balfour-Browne vid. 1956/5524 E91+/Naturhistoriska Riksmuseet Stockholm Loan No. 96/03/*exilis* Boh."

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "CPr Tsitsikama Forest/marettes/25.IX. 59" (1 ex. MNHN); "ECPr Humansdorp" (1 ex. AMS). WESTERN CAPE: "Male/Cape G.H. 3688/Cape of Good Hope C. Darwin/Darwin Coll. 1885. -119/*C. exilis* (Boh.) J. Balfour-Browne det. T. 1956 compared with type (1 ex. BMNH); "WCPr, stream with pools in pine wood, Caledon 11.XI. 47" (2 exx. AMS); "WCPr Berg River Wellington 10.VII. 51/*C. exilis* Boh. det. Omer-Cooper" (1 ex. AMS); "CPr Cape Town Table mntn 15.XII. 50" (1 ex. AMS); "near Paarl 420 ft 10.VIII. 1954/shallow water, rivulet/*C. exilis* Boh. J. Balfour-Browne det. XII. 1960 (1 ex. BMNH); "WC Hex Riv. Mts 7 km SW Ceres 33.23S-19.19E, 500 m NN, 25.II. 97" (17 exx. NMW, 3 exx. MZH). In all, 28 specimens studied.

DIAGNOSIS. Within the group, *C. exilis* is distinguished by its less broad body and by the apex of the penis in lateral view, which becomes gradually narrower towards the apex.

DESCRIPTION. Body. Length 1.84-2.10 mm, width 1.04-1.16 mm. Oval. Blackish ferrugineous to dark ferrugineous, dorsal colour pattern rather vague (fig. 63).

Head. Almost unicoloured, dark ferrugineous to ferrugineous. Frontal outline curved, medially almost straight. Frontomedial minute impressions fine but clearly discernible. Frontal depressions shallow, rather vague. Finely and rather sparsely punctate. At inner margin of eyes, a few slightly coarser punctures. Submat, microsculptured. Antenna with segments 1-4 pale ferrugineous and 5-11 darker, partly dark ferrugineous. Segments 4-10 about as long as broad.

Pronotum. Ferrugineous to dark ferrugineous, at base and anteriorly with a narrow black to blackish ferrugineous area. Lateral outline curved. At margins, an irregular row of punctures. Ordinary punctation fine, fairly dense. Submat, microsculptured.

Elytra. Dark ferrugineous with a blackish ferrugineous to black vaguely delimited medial area (fig. 63). Discal row of punctures at base discernible; consists of sparse, longitudinally somewhat extended punctures. Other rows of punctures weakly developed and indistinct; mixed with ordinary punctation and hardly visible. Ordinary punctures fine, fairly dense, and almost evenly distributed. Submat, microsculptured. Epipleuron ferrug-



ineous, punctation indistinct, with fine reticulation.

Ventral aspect. Ferruginous to blackish ferruginous, prothorax partly paler. Prosternal process moderately elevated, apex enlarged and laterally margined. Medial surface of process impunctate. Metasternal lines absent. Abdomen at base with punctures; punctation otherwise sparse and irregular. Finely and partly indistinctly microsculptured.

Legs. Pale ferruginous to ferruginous. Protarsus somewhat enlarged.

Male. Genitalia as in figs 64-66.

Female. Externally as male. Spermathecal tract as in fig. 67.

DISTRIBUTION. South Africa (Eastern Cape, Western Cape) (fig. 177).

BIOLOGY. Collected in a rivulet with shallow water and in small pools.

*Canthyporus nebulosus* Omer-Cooper (figs 68-74, 176)

*Canthyporus nebulosus* Omer-Cooper, 1965:159 (orig. descr.): Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, Kwazulu-Natal, Champagne Castle.

TYPE MATERIAL. Lectotype ♂ in BMNH, by present designation: "Syntype/ Type/ Indumeni River above Forest, in small rock pool. Cathedral Peak. March 1959 B.R. St./Brit. Mus. 1978-308". Paralectotype: same data as lectotype (1 ♀ BMNH).

Note. Lectotype and paralectotype mounted on same label; lectotype mounted in front slightly on left side of label; male genitalia laterally on right. Paralectotype mounted on left side of label, behind lectotype.

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "EC 7.III. 1997 Tsitsikama Mts 40 km E Plettenberg Bay 34.05S-23.21E" (5 exx. NMW, 1 ex. CWV); EC 9.III. 1997 Amatola Mts 20 km NNE Alice 32.47S-26.50E" (1 ex. NMW); "Grahamstown 2000 ft. 23.III. 1954/on water trickling over sheer rock" (5 exx. BMNH). WESTERN CAPE: "Cape Town Devils Peak 2000 ft. 7.III. 1954/rivulet through moss on rock face" (14 exx. BMNH, 4 exx. MZH); "Cape Town Devils Peak 2000 ft. 7.III. 1954/in trickling water on rock-face" (1 ex. BMNH) [Note. The 19 specimens from Devils Peak were designated as type material for a manuscript species of J. Balfour-Browne, but remained undescribed]; "C. Province Blinkwater Falls 1650 ft. 2.III. 1954/on wet mossy cliff face" (4 exx. BMNH); "Blinkwater Falls Table Mtn 6.XI. 49 (west)/under stones at base of falls/*C. nebulosus* O.-C. J. Balfour-Browne det. 69" (1 ex. CAS); "W Cape, pond ca. 20 km NE Clanwilliam, Cederberg Mts, Sept. 2002" (3 exx. CBP); "WCPr Upper Berg Riv. 1951/*C. nebulosus* n.sp. det. J. Omer-Cooper" (1 ex. AMS); "Capl. Rifl. Range Simonst. 20.VII. 03" (1 ex. MNB); "WC Hex Riv. Mts 7 km SW Ceres 33.23S-19.19E, 500 m NN 25.II. 97" (8 exx. NMW); "WC Du Toits Mts 9 km SE Franschhoek 33.55S-19.08E, 28.II. 1997 (1 ex. NMW); "Cape Distr. Du Toit's Kloof 22.XI. 1949/under stones in tiny spring, among algae, in bottom gravel/*C. nebulosus* O.-C. det. J. Balfour-Browne 1969" (12 exx. CAS); "WC 3.IX. 2003, 333843S-19062E, Bainskloof Pass on R301 N Wellington, alt. 541 m, Turner, Mann, Reavell" (2 exx. MZH, 12 exx. NMW); "WC Bainskloof Pass above Wellington, Sept. 2002, seepages on rock face" (17 exx. CBP, 1 ex. MZH); "W Cape, Sept. 2002, Michell's Pass below Ceres, seepages on rock face" (28 exx. CBP); "SW Cape Mts Hawequas SE 1100 m, 33.41S-19.06E/5.XI. 73 water coll in rapid" (3 exx. TMP); "SW Cape Hawaquas rad. Tower 33.41S-19.06E/27.X. 1987 shore washing" (1 ex. MZH, 1 ex. TMP); "WC 5.IX. 2003, 332107S-220246E, Swartberg Pass, Swartberg Mtns, alt. 1574 m, Turner, Mann, Reavell leg." (1 ex. MZH, 6 exx. CTP). In all, 137 specimens studied.

DIAGNOSIS. See diagnosis of *C. brincki*.

DESCRIPTION. Body. Oval, moderately sized, length 1.94-2.22 mm, width 1.08-1.24 mm.



Dorsal colour pattern mainly rather vague (fig. 68). Sometimes elytral colour pattern quite distinct (fig. 69).

Head. Dark brown to dark ferrugineous, frontally paler, pale ferrugineous to ferrugineous. Frontal outline curved, medially somewhat straightened. Mid-frontally, two minute punctures. Frontal depressions shallow, indistinct; at same location, a group of four to five punctures. At inner margin of eyes, a row of punctures. Indistinctly punctate; punctures hidden by distinct reticulation which covers entire head. Despite reticulation, head surface rather shiny. Antenna pale ferrugineous, apical segments partly darkened, comparatively short, segments 5-10 broader than long (fig. 70).

Pronotum. Blackish ferrugineous to dark ferrugineous, laterally with broad pale ferrugineous area. Lateral outline curved. Punctuation very fine, sparse, along margins somewhat denser. Distinctly reticulated, but still rather shiny.

Elytra. Blackish brown to blackish ferrugineous, with vague, slightly paler, pale ferrugineous to ferrugineous areas (fig. 68). Colour pattern sometimes in part delimited to spots, distinct (fig. 69). Punctuation fine to very fine, rather indistinct, and somewhat irregularly distributed, partly absent. Discal row of punctures clearly discernible, consisting of sparse, slightly irregularly located punctures. Dorsolateral and lateral rows of punctures as discal row but slightly sparser. Sutural row of punctures often hardly discernible; sometimes a few basal punctures form a start of the sutural line. Distinctly reticulated but still rather shiny. Epipleuron pale ferrugineous, punctuation indistinct, finely reticulated.

Ventral aspect. Black to dark ferrugineous. Prosternal process only slightly elevated and provided with a hair tuft. Apex of process enlarged, flat, laterally margined. Punctuation indistinct and extensively absent. With distinct longitudinal reticulation, which almost fades away close to the midline.

Legs. Pale ferrugineous. Pro- and mesotarsi enlarged.

Male. Genitalia as in figs 71-73. Note that penis of lectotype is almost broken at its base.

Female. According to the original description the female has stronger reticulation on its head; its elytral rows of punctures are also more strongly developed, and at their bases is a small group of large punctures. We have experienced difficulties in the separation of sexes using external features. Spermathecal tract as in fig. 74.

DISTRIBUTION. South Africa (Eastern Cape, Kwazulu-Natal, Western Cape) (fig. 176).

BIOLOGY. Sampled in rivulets and trickling water on rock-face with moss at altitudes between 450 and 600 m a.s.l. Also sampled under stones, e.g. in tiny spring, among algae, in bottom gravel. Turner et al. collected the species in a stream. Turner also sampled the species in seep with algae at the side of trickling water near the top of a mountain.

#### Group *hottentottus*

The *hottentottus* group includes 11 species from southern Africa plus the seven species known from Ethiopia, Kenya, Madagascar, Sud-Kivu, and Tanzania. The penis has a dorsal projection, and the parameres lack hair and an apical incision (unknown in *C. subparallelus*). The females have an extended spermathecal tract with a loop (unknown in several species). Within this group, the three South African species *C. angustatus*, *C. fluviatilis*, and *C. lowryi* form a well-supported clade. In these three species, the male pro-



tarsal claws are long and extended, and the metatibia is distinctly curved. Moreover, the dorsal process of the penis is strongly dilated in dorsal view.

*Canthyporus alpestris* Guignot (figs 75-78, 171)

*Canthyporus alpestris* Guignot, 1936:35 (orig. descr.): Guignot, 1946a:313 (disc.), 1951b:126 (faun.), 1956:253 (faun.), 1959:419 (descr.), 1961:934 (faun.); Bertrand, 1963:437 (faun.); Birlardo & Sanfilippo, 1979:89 (descr.); Wewalka, 1981:61 (descr.); Nilsson, 2001:145 (cat.).

*Canthyporus kilimandjarensis* Régimbart: Guignot, 1946a: 314 (nom. nudum).

TYPE LOCALITY. Tanzania, Kilimandjaro.

TYPE MATERIAL. Holotype ♂ deposited in MNHN: "Kilimandjaro zone alpine Forêts supér. 2500-3000 m Ch. Alluaud X. 1908/2750 m/male/Type/Det. Dr. Guignot *Canthyporus alpestris* n.sp. Type". Paratype: same data as holotype, but labelled "Paratype", and also "Museum Paris collection Guignot" (1 ♂ MNHN).

Note. Holotype has earlier been dissected and genitalia removed from specimen - not mounted on card with specimen and obviously lost. In the original description, the single paratype is incorrectly described as being female. This error was corrected by Guignot (1959:421, footnote). In all, two specimens studied.

DIAGNOSIS. *Canthyporus alpestris*, *C. pauliani*, and *C. petulans* are all characterized by a slightly upwards curved apex of the penis in combination with the apical part of the penis forming an angle of almost 45 degrees with the dorsal process of the penis (lateral aspect). *Canthyporus petulans* is separated from the two other species by having a long and slender penis apex (dorsal aspect); the corresponding feature in the two other species is distinctly broader compared with the basal part of penis. *Canthyporus alpestris* and *C. pauliani* can be identified by examination of external characters as follows: *C. alpestris* is distinctly longer (2.32-2.56 mm) than *C. pauliani* (1.92-1.94 mm), and additionally, medial segments of the antenna are longer than broad in *C. alpestris*, while they are almost equally long as broad in *C. pauliani*.

DESCRIPTION OF MALE. Body. Length 2.32-2.56 mm, width 1.20-1.28 mm. Oval, dorsal colour pattern as in fig. 75.

Head. Dark ferrugineous to ferrugineous, anteriorly with narrow pale ferrugineous area. Anteriorly, between eyes, almost evenly curved. Frontally, in middle, with short, somewhat indistinct, transverse furrow. Frontal depressions shallow, although clearly discernible. At eyes, a row of punctures. Punctuation fine to very fine, sparse. Submat, distinctly reticulated. Antenna pale ferrugineous, segments 5-11 rather short and broad; their anterior part vaguely darker.

Pronotum. Pale ferrugineous to ferrugineous, medially with a large dark ferrugineous marking. Laterally with fine bead; lateral outline evenly curved. At margins, rows of fine punctures. Discally, punctuation fine to very fine, sparse. Slightly mat, microsculpture distinct.

Elytra. Ferrugineous to brownish. At suture and at pronotum, narrow, vague darker area (fig. 75). Discal row of punctures distinct; consists of quite coarse and slightly irregular punctures. Dorsolateral row of punctures and lateral row of punctures irregular and sparse. Between discal and dorsolateral rows, a few coarser punctures. Ordinary punctuation fine to very fine, sparse, partly indistinct. Submat, finely reticulated. Epipleuron pale ferrugineous, impunctate, finely reticulated, and rather shiny.



Ventral aspect. Pale ferrugineous to ferrugineous. Apex of prosternal process somewhat enlarged, laterally with bead, and medially forming a slight keel (at lateral margins with fine punctures). Almost impunctate. Finely microsculptured, slightly mat.

Legs. Pale ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 76-78.

Female. Unknown.

DISTRIBUTION. Tanzania (Kilimandjaro) (fig. 171).

BIOLOGY. Collected in the alpine forest zone (2750 m a.s.l.).

*Canthyporus alvei* Omer-Cooper (figs 79-83, 174)

*Canthyporus alvei* Omer-Cooper, 1965:156 (orig. descr.): Wewalka, 1981:58 (disc.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Murraysburg.

TYPE MATERIAL. Lectotype ♂ in BMNH, by present designation: "Syntype/Type/E. Cape Province Murraysburg 13.I. 1958/*Canthyporus alvei* n.sp. Det. J. Omer-Cooper/Brit. Mus. 1978: 308" (BMNH).

Paralectotype: same data as lectotype (1 ♀ BMNH).

Note. Earlier, the lectotype and paralectotype were mounted on same label. Now separated and mounted on own labels but still pinned together and provided with lecto- and paralectotype label.

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: "CPr. Karoo NP 32,15.3S-22,29.9E, 17.XI. 1997, swamp at Puttersvlei, swamp vegetation treating, water catcher" (1 ex. MNB); C Pr. Karoo NP 32,13.6S-22,31.6E, 17.XI. 1997, mountain view river, shore, *Phragmites*, grass litter sievings 900 m" (1 ex. MNB, 1 ex. MZH); "CP 22 mi N Nelspoort 3.III. 1968" (1 ex. USNM). In all, six specimens studied.

DIAGNOSIS. Externally, *C. alvei* resembles *C. petulans* and the two species may be difficult to separate without dissection of male genitalia. They are easily distinguished by examination of the penis. In *C. alvei*, the dorsal penis process does not form an almost 45 degree angle with apical part of penis, as is the case in *C. petulans*. Instead, the dorsal process and the apical part of the penis point almost in the same direction, the angle between them being about 15 degrees. See also diagnosis of *C. alpestris*.

DESCRIPTION (only relevant differences from *C. petulans* given). Body. Length 2.88-3.12 mm, width 1.48-1.60 mm. Dorsal appearance as in fig. 79.

Head. Dark ferrugineous, frontally only indistinctly paler than on other parts of head. On each side of midline, frontally, two minute and hardly discernible punctures.

Pronotum. As in *C. petulans*, but additionally provided with vague, dark, discal markings (fig. 79). Discally, in middle, with very fine, partly hardly discernible punctation.

Elytra. Colour pattern vague (fig. 79). Ordinary punctation very fine. Epipleuron very finely reticulate.

Ventral aspect. Punctation almost totally absent.

Legs. Pro- and mesotarsi somewhat enlarged.

Male. Genitalia as in figs 80-82.

Female. Externally as male. Spermathecal tract as in fig. 83.

DISTRIBUTION. South Africa (Western Cape) (fig. 174).

BIOLOGY. Almost unknown. Collected in a swamp and at a river shore (see material studied).



*Canthyporus angustatus* Omer-Cooper (figs 84-88, 175)

*Canthyporus angustatus* Omer-Cooper, 1965:152 (orig. descr.): Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Grabouw.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/Holotype/W. Province Grabouw 18.I. 1959/*Canthyporus angustatus* n.sp. Det. J. Omer-Cooper/Brit. Mus. 1978-308/*Canthyporus angustatus* J. O-C. M.E. Bacchus det. 1978 Holotype". In all, one specimen studied.

DIAGNOSIS. The three species *C. angustatus*, *C. fluviatilis*, and *C. lowryi* are all characterized by the dorsal process of the penis, which in dorsal view is strongly enlarged towards its apex. *Canthyporus lowryi* is distinguished from the two others by the male metatibia, which is strongly curved, while it is almost straight in *C. angustatus* and *C. fluviatilis*. Finally, *C. angustatus* is separated from *C. fluviatilis* by the shape of the dorsal process of the penis, being basally comparatively slender in *C. angustatus*, and robust and compact in *C. fluviatilis*.

DESCRIPTION OF MALE (only relevant differences from *C. fluviatilis* given). Body. Length 3.04 mm, width 1.48 mm. Colour pattern predominantly vague; clearly discernible on pronotum (fig. 84).

Head. Unicoloured pale ferrugineous. Frontal depressions shallow and hardly discernible.

Pronotum. Discal punctation very fine, partly absent.

Elytra. Colour pattern indistinct and vague (fig. 84).

Ventral aspect. Dark ferrugineous to pale ferrugineous, lacks distinct colour pattern: palest on prothorax and darkest frontally on metacoxal plates and close to epipleural cavity.

Legs. Protarsal claws slightly extended and somewhat robust. Metatibia with hair tufts as in fig.88.

Male. Genitalia as in figs 85-87.

Female. Unknown.

DISTRIBUTION. South Africa (Western Cape) (fig. 175).

BIOLOGY. Unknown.

*Canthyporus consuetus* Omer-Cooper (figs 89-93, 176)

*Canthyporus consuetus* Omer-Cooper, 1965:151 (orig. descr.): Mazzoldi, 1997:602-603 (descr. female); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Grabouw.

TYPE MATERIAL STUDIED. Lectotype ♂ in BMNH, by present designation: "Type male/ Syntype/ Type/ W Province Grabouw 1.XII. 1959/ *Canthyporus consuetus* n.sp. Det. J. Omer-Cooper/Brit. Mus. 1978-308". Paralectotype ♀: labelled as "Type female" and pinned together with lectotype.

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: same collecting data as holotype but not labelled as type material (4 exx. AMS); "CPr Karoo NP 32,15.3N-22,29.9E, 17.XI. 1997, swamp vegetation treating, water catcher" (1 ex. MNB, 1 ex. MZH); "CPr Karoo NP 32,13.6N-22,31.6E, 17.XI. 1997, Mountain View River, shore, *Phragmites* grass ? litter sievings 900 m" (1 ex. MNB); "CPr. Breede Riv./14.IX. 59" (1 ex. MNHN). In all, 10 specimens studied.

DIAGNOSIS. A distinct species characterized by predominantly pale head, by very fine and sparse ordinary punctation of elytra, and by peculiar shape of penis: apex of penis slen-



der (dorsal aspect) and strongly curved upwards in lateral view. Dorsal process initially follows penis approximately same direction, apically, however, strongly bent and with a marked deviation. *Canthyporus consuetus* resembles in some respect *C. petulans*. The two species are externally easily separated by the distinctly denser ordinary elytral punctures and dark head of *C. petulans*. See also diagnosis of *C. cooperae*.

DESCRIPTION. Body. Length 2.40-2.56 mm, width 1.24-1.32 mm. Almost oval, lateral outline curved, unbroken. Dorsal colour pattern vague (fig. 89).

Head. Pale ferrugineous, posteriorly in middle and at eyes, vague, slightly darker areas. Sometimes dark area distinct. Frontal outline evenly curved. Frontally, in middle, minute, hardly discernible, transverse furrow. Frontal depressions vague. Punctuation fine to very fine, sparse, partly absent. Submat, distinctly reticulated. At inner margin of eyes, a slightly irregular row of punctures. Antenna moderately long, segments 1-4 pale ferrugineous, segments 5-11 each in terminal part darkened.

Pronotum. Pale ferrugineous, with medial part (extending from base to anterior margin) somewhat darkened and vague in its delimitation. Laterally, weakly but evenly curved. At margins, a somewhat irregular row of punctures. Ordinary punctures fine to very fine, sparse. Submat, meshes of microsculpture distinct.

Elytra. Pale ferrugineous to pale brownish, slightly darker than main colour of pronotum. Colour pattern indistinct (fig. 89). Discal row of punctures slightly irregular but quite distinct. Dorsolateral and lateral rows of punctures also discernible but finer and slightly more irregular. Along suture, with an additional and somewhat sparse row of punctures. Ordinary punctuation very fine, sparse, slightly irregularly distributed, partly hardly visible. Submat, reticulation distinct. Epipleuron pale ferrugineous, almost impunctate, submat and finely reticulated.

Ventral aspect. Ferrugineous to pale ferrugineous. Apex of prosternal process moderately elevated. Apex enlarged, laterally beaded, medial area with fine punctures. Ventral surface of body otherwise almost impunctate; fine, sparse (rudimentary) punctures discernible. Submat, with fine reticulation; meshes of reticulation elongated.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 90-92.

Female. External differences from male seemingly minimal. Spermathecal tract as in fig. 93.

DISTRIBUTION. South Africa (Western Cape) (fig. 176).

BIOLOGY. Almost unknown. Mazzoldi (1997) reports the species from a small stream. According to collecting labels, collected in a swamp and on a river shore (see above).

*Canthyporus cooperae* Guignot (figs 94-99, 174)

*Canthyporus cooperae* Guignot, 1951a:23 (orig. descr.): 1959:418 (descr.); Omer-Cooper, 1956:304 (disc.), 1962:296 (faun.), 1965:152 (descr.); Bertrand & Legros, 1971:249 (faun.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Eastern Cape, Hogsback.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/Hogsback 19:VII:1946 J. Omer-Cooper/*Canthyporus cooperae* Guign. Type, male/Brit. Mus. 1956-157/Dr. F. Guignot det., 1950 *Canthy-*



*porus cooperae* Guign. Type". Paratypes: same data as holotype, but labelled: "Allotype, female" (1 ♀ MNHN); "Paratype" (1 ex. AMS, 1 ex. MNHN).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "ECPr. Hogs back (?) 1942/*C. cooperae* Guign. det. Omer-Cooper" (1 ex. AMS); "ECPr. Hogs back 18.VI. 1946/*C. cooperae* Guign. det. Omer-Cooper" (4 exx. AMS). In all, nine specimens studied.

DIAGNOSIS. This species resembles *C. consuetus* but may be distinguished by its larger body and by differences in the shape of the penis apex, the lateral aspect of which is only slightly curved upwards.

DESCRIPTION. Body. Length 2.92-3.24 mm, width 1.36-1.60 mm. Almost oval, slightly dorsoventrally flattened and with a vague colour pattern (fig. 94).

Head. Ferrugineous, frontally broadly slightly paler (delimitation of pale area diffuse). Frontal outline almost evenly curved. Frontal depressions shallow, clearly discernible, but their delimitation indistinct. Medially, at frontal margin, two transversely slightly extended minute punctures. Punctuation very fine, sparse. Row of puncture at inner side of eye rather fine and slightly indistinct. Submat, finely reticulated; meshes of microsculpture clearly discernible. Antenna pale ferrugineous, rather slender.

Pronotum. Ferrugineous, with vague, somewhat darkened mediobasal marking, which extend to the frontal margin of the pronotum. Lateral outline evenly curved. Punctuation very fine, sparse. Rather shiny, although finely microsculptured. Along anterior and lateral margins, with a somewhat irregular row of punctures.

Elytra. Dark to pale ferrugineous, colour pattern vague; darkest at suture and palest laterally (fig. 94). Discal row of punctures rather distinct; posteriorly row becomes irregular. Dorsolateral and lateral rows of punctures finer, sparser, and more irregular. Ordinary punctuation fine to very fine and sparse. Submat, finely microsculptured. Epipleuron pale ferrugineous, almost impunctate, very finely reticulated.

Ventral aspect. Prothorax and metacoxal plates black to dark ferrugineous, abdomen dark ferrugineous to brownish, apically somewhat paler. Prothorax pale ferrugineous. Apex of prosternal process moderately elevated, enlarged, and laterally narrowly margined; medial surface of process with fine punctures. Ventral aspect of body otherwise almost impunctate; very fine scattered punctures may be discerned. Rather shiny, although with extensive reticulation. Metathorax only with rudimentary reticulation.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi somewhat enlarged.

Male. Genitalia as in figs 95-97. Figs 96-97 drawn from a permanent preparation, which does not provide a view of the ventral aspect of the penis. Ventral aspect (fig. 95) drawn from another specimen.

Female. Pro- and mesotarsi slender. Spermathecal tract as in figs 98-99.

DISTRIBUTION. South Africa (Eastern Cape) (fig. 174).

BIOLOGY. Unknown.

*Canthyporus fluviatilis* Omer-Cooper (figs 100-106, 176)

*Canthyporus fluviatilis* Omer-Cooper, 1956:303 (orig. descr.): 1962:296 (faun.), 1965:152 (descr.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, Eastern Cape, Humansdorp District, Storm's River.



TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/E. Cape province Storm's River Humansdorp dist. 6.9. 1955/*C. fluviatilis* n.sp.". Paratypes: principally same data as holotype (3 exx. AMS, 1 ex. BMNH); "S. Africa E Cape Province Humansdorp/7.I. 1956 J. Omer-Cooper/ Paratype/ male/ Paratype/ *Canthyporus fluviatilis* det. J. Omer-Cooper" (1 ex. MNHN).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: "Cape Province Storms Riv. 19.III. 1954/In swampy back water/*Cathyporus fluviatilis* O-C. det. J. Balfour-Browne 57" (2 exx. BMNH); WCPr Little stream Forest Inn, Storms River 4.XII. 1959 (6 exx. AMS). WESTERN CAPE: "CPr. 2 mi SW Citrusdal 30.IV. 58, 150 m/*C. fluviatilis* O-C. det. Omer-Cooper" (2 exx. CAS). In all, 16 specimens studied.

DIAGNOSIS. See diagnosis of *C. angustatus*.

DESCRIPTION. Body. Length 2.84-3.24 mm, width 1.40-1.60 mm. Dorsoventrally slightly flattened. Shape slightly elongated. Colour pattern partly somewhat vague (fig. 100).

Head. Dark ferrugineous, anteriorly with narrow pale ferrugineous area. Laterally, posterior to eyes, with minute pale ferrugineous spot (difficult to see from above). Frontal outline curved. Medially, at anterior margin, two minute, hardly visible, transverse punctures. Frontal depressions quite shallow but clearly discernible. Rows of punctures at eyes moderately strongly developed. Punctuation fine, sparse, and quite evenly distributed. Submat, distinctly reticulated. Antenna quite slender, pale ferrugineous to ferrugineous.

Pronotum. Laterally with fine bead; outline evenly curved. Pale ferrugineous, medially with a dark longitudinal marking, which connects frontal and posterior dark areas (fig. 100); sometimes dark marking broken. At margins, with dense somewhat irregular rows of punctures. Discal punctuation fine and sparse. Submat, finely reticulated.

Elytra. Ferrugineous to pale brownish, with vague, somewhat darker, extensive marking. Discal row of punctures distinct. Dorsolateral and lateral row of punctures sparse and irregular. Ordinary punctures fine and sparse, quite evenly distributed. Slightly mat, distinctly reticulated. Epipleuron pale ferrugineous, impunctate, finely reticulate.

Ventral aspect. Thorax almost totally pale ferrugineous, other parts black to dark ferrugineous. In lateral view, apex of the prosternal process moderately elevated. Apex of the prosternal process somewhat enlarged, flat, laterally beaded; its medial flat area finely punctate. Almost impunctate. Finely reticulated (appearance of meshes variable).

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi somewhat enlarged. Protarsal claws extended (fig. 106). Metatibia basally on inner side with long hair tufts, and metafemur at posterior margin distinctly expanded (fig. 105).

Male. Genitalia as in figs 101-103.

Female. Spermathecal tract as in fig. 104. Protarsal claws and hind leg not modified.

DISTRIBUTION: South Africa (Eastern Cape, Western Cape) (fig. 176).

BIOLOGY: According to label data, collected in a swampy back water.

*Canthyporus hottentottus* (Gemminger & Harold) (figs 107-111, 175)

*Hydroporus collaris* Boheman, 1848:255 (orig. descr.) (preocc. by Hope 1841); Branden, 1885:51 (cat.).

*Hydroporus hottentottus* Gemminger & Harold, 1868: 434 (repl. name); Sharp, 1882:796 (descr.).

*Hydroporus hottentotus* Gemminger & Harold, 1868 (misspell.): Régimbart, 1895:30 (syn.).



*Canthyporus hottentottus* (Gemminger & Harold, 1868): Guignot, 1936:34 (list); Nilsson, 2003:67 (spelling); Toledo & Turner, 2004: 36 (faun.).

*Canthyporus hottentotus* (Gemminger & Harold, 1868) (misspell.): Zimmermann, 1919:160, 1920:134 (list); Guignot, 1959a: 415 (descr.); Omer-Cooper, 1962:293 (faun.), 1965:154 (faun.); Bertrand, 1963:437 (faun.); Bertrand & Legros, 1967:867 (faun.); Wolfe, 1985:136, 1988:329 (descr.); Mazzoldi, 1997:601 (descr. female); Nilsson, 2001:146 (cat.).

*Hydroporus advena* Sharp, 1882:486: (orig. descr.): Branden, 1885:51 (cat.).

TYPE LOCALITY. Of *collaris* (and *hottentottus*) South Africa, Caffraria interiore; of *advena* South Africa, Western Cape, Cape Town.

TYPE MATERIAL. Lectotype ♂ of *collaris* (and *hottentottus*), in RMS by present designation: “Caffraria./J. Wahlb./Type/Typus/collaris Boh./191 54/J. Balfour-Browne vid. 1955/5526 E91/Naturhistoriska Riksmuseet Stockholm Loan no. 43/03”. Paralectotypes: “Caffraria./J. Wahlb./Naturhistoriska Riksmuseet Stockholm Loan no. 44-46/03” (3 exx. RMS).

Syntype ♂ of *advena*, deposited in BMNH: “Type H.T./Sharp Coll. 1905-313/Cape Town/Type 228 *Hydroporus advena* n.sp. Cape Town”.

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: EASTERN CAPE: “EC 7.IX. 2003 340139S-235328E, alt. 10 m, Tsitsikamma Nat. Park Turner, Mann, Reawell leg.” (1 ex. CTP); same data but “alt. 2 m” (5 exx. MZH, 82 exx. CTP); “ECPr Humansdorp Witte Els Bosch 7.I. 56” (1 ex. AMS); “ECPr Humansdorp Distr. 18.I. 1958” (1 ex. AMS); “Kromme R. Nat. Rd. Humansdorp 17.II. 47” (1 ex. AMS); “ECPr Unionsdale Prince Alfred’s Pass, stream 13.V. 1957” (2 exx. AMS); “CPr Albany District Gaileskloof 5.VIII. 1939” (1 ex. AMS); “Karreedouw elev. 300 m, 22.IV. 58” (1 ex. CAS); “ECPr Bathurst Distr. Quarry pond Lushington Hill 5.VII. 1946” (1 ex. AMS); “Cape” (1 ex. BMNH). NORTHERN CAPE: “6 mi S Garies 2500 ft 18.VII. 1954/small muddy ephemeral pool” (6 exx. BMNH); “Namaqualand Springbok Mesklip 29.49S-17.52E/30.VIII. 76 in water” (1 ex. TMP); “Namaqualand Kamieskroon 30.12S-18.01E/27.VIII. 77 seas. Riv. Stones” (1 ex. TMP). WESTERN CAPE: “C Pr Blinkwater Falls 1650 ft 2.III. 1954/in running water/C. *hottentotus* G. & H. J. Balfour-Browne det. 1955” (7 exx. BMNH); “Cape town/*Hydroporus hottentotus*” (4 exx. MNHN); “Cape Flats *Isoetes vlei*/13.VII. 1946” (1 ex. MNHN); “Cape Flats ca 3.5 mi SE Philippi 5.III. 1954/among dense *Hydrodictyon* in evanescent vlei/C. *hottentotus* G. & H. J. Balfour-Browne det. 1962” (3 exx. BMNH); “Cape Flats ca 3.5 mi SE Philippi 5.III. 1954/in grassy evanescent vlei with Algae and *Isoetes*” (7 exx. BMNH); “CPr. Cape Flats Strandfontein 8.XII. 50” (1 ex. LUZ); “Cape Flats *Isoetes Vlei* 13.VII. 1946/C. *hottentotus* G. & H. det. Guignot 1950” (1 ex. AMS); “Cape Flats, stream opp. Golf course Wynbers 13.IV. 1946” (1 ex. AMS); “WC 2.IX. 2003, 325648S-180554E, alt. 36 m, sout rivier to S of R45 in Hopefield” (1 ex. CTP); “WC 2.IX. 2003, 330611S-182522E, alt. 41 m, in pools, R45 E of Hopefield” (3 exx. CTP); “WC 2.IX. 2003, 330727S-18052E, at junction for Mooimark, West Coast Nat. Park, alt. 44 m, Turner, Mann, Reavell leg.” (4 exx. CTP); “WC 2.IX. 2003, 331408S-18081E, alt. 50 m, Abrahams Kraal, West Coast Nat. Park, Turner, Mann, Reavell leg.” (1 ex. CTP); “WC 12.IX. 2003, 340949S-182558E, alt. 3 m, Glencairn Vlei Res., open pools surrounded by reeds on sandy substrate” (1 ex. CTP); “WC, W Coast NP, lagoon S Langebaan Sept. 2002” (28 exx. CBP); “Ratel R. 30.VII. 1946” (2 exx. AMS); “Cape Penin. Hout Bay 10-15.XI. 1954/C. *hottentotus* Gemm. & Har. det. Omer-Cooper” (7 exx. TMP); “Kalabaskraal ca 350 ft 27.VII. 1954/roadside pond, open water with *Scirpus*/C. *hottentotus* G. & H. J. Balfour-Browne det. 1962” (1 ex. BMNH); “Kalabaskraal ca 350 ft 27.VII. 1954/roadside pond, much *Juncus* & *Nitella*/C. *hottentotus* G. & H. J. Balfour-Browne det. 1963” (1 ex. BMNH); “Nr Kommetje 200 ft 30.VII. 1954/in running stream with *Glyceria* sp.” (1 ex. BMNH); “C Pr Cape Distr./Kirstenbosch, Bot Garden 28.II. 1954 in stream/C. *hottentotus* G. & H. J. Balfour-Browne det. 1955” (1 ex. BMNH); “WC Table Mtn 33.58S-18.28E bei Kirstenbosch, Skeleton Gorge 300-



700 m NN, 4.III. 97/*C. hottentotus* G. & H. det. Wewalka 98" (1 ex. NMW); "Rondebosch 6.VIII. 1954/in brown acid water, epehemeral pool" (2 exx. BMNH); "CPr Cape Town Table Mntn 1050-1070 m, 33,58S/18,25E, 7.XI. 1997" (1 ex. MNB); "C Colony/Table Mt. 19.VIII. 1905" (1 ex. BMNH); "Tafelberg b. Kapstadt II. 1904/*C. hottentotus* G. & H. det. Wewalka 1984" (7 exx. MNB, 1 ex. MNHN); "CPr. Cape Town Table Mnt. 15.XII. 50/2800 ft./*C. hottentotus* Gemm. & Har. det. Omer-Cooper" (55 exx. LUZ); "CPr. Table Mt. 10.XII. 50/*C. hottentotus* Gemm. & Har. det. Persson (1 ex. LUZ); "Cape Town, Table Mntn 26.XI. 95/*C. hottentotus* Gemm. & Har. det. Nilsson-96" (6 exx. CNU); "Disa R., Orangekloof Table Mntn, Cape Town 19.II. 1997" (1 ex. CTP); "Disa Gorge, east stream above Hely-Hutchinson reservoir, Table Mntn, Cape Town 27.II. 1997 samples from rock turning" (2 exx. CTP); "Table Mntn, below Hely-Hutchinson reservoir 27.II. 1997" (19 exx. CTP); "Cape Town, Table mntn (W side) Kasteelspoort riv. 20.II. 1997" (10 exx. CTP); "Cape Town" (33 exx. MNHN, 1 ex. BMNH, 15 exx. ZFMB); "Cape Town I. 92" (7 exx. AMS); "WCPr sand vlei, lake side, C. Town 22.XI. 1947" (2 exx. AMS); "WC 11.IX. 2003, 341227S-182733E, rockpools opp. Oatlands, alt. 1 m, Turner, Mann, Reavell leg." (1 ex. CTP); "WC, 8.IX. 2003, alt. 134 m, sandy bottomed far, res." (21 exx. CTP); "WC, pond at R315 ca. 10 km E Darling, Sept. 2002" (15 exx. CBP); "SW Cape Hawaquas rad. Center 33.41S-19.06E/27.X. 1978 shore washing" (2 exx. MZH, 1 ex. TMP); "SW Cape Mts. Hawaquas SE, 1100 m, 33.41S-19.06E/5.XI. 73 water coll. in rapid" (1 ex. TMP); "S Cape Mt Helderfontein 1150 m, 33.55S-20.52E/31.X. 78 river stones" (1 ex. TMP); "WC, 9.IX. 2003, 342949S-202553E, alt. 17 m, De Hoop Vlei, S end, De Hoop Res." (13 exx. CTP); "WC 9.IX. 2003, 342732S-205113E, De Hoop Res., Turner, Mann, Reavell leg." (1 ex. MZH, 7 exx. CTP); "WC, 10.IX. 2003, 342924S-200537E, alt. 51 m, S De Hoop-Ouplas junction, Turner, Mann, Reavell leg." (2 exx. CTP); "WC, 9.IX. 2003, 342723S-202619E, alt. 13 m, De Hoop Res., artificially maintained game pan" (27 exx. CTP); "WC West Coast NP: Abrahamskraal 33,13.9S/18,08.1E, waterhole litter treated 4.IV. 1998" (5 exx. MNB, 2 exx. MZH); "WC Stellenbosch Mts 10 SE Stellenbosch 33.56S-18.51E Jonkershoek 28.II. 1997/*C. hottentotus* G. & H. det. Wewalka" (6 exx. NMW, 1 ex. CWV); "WCPr Krom R. Stellenbosch" (1 ex. AMS); "WC 4.IX. 2003, 334943S-200531E, alt. 263, river E Ashton on Montague rd" (1 ex. CTP); "CPr. Gordon's Bay/mare zone littorale/20.IX. 59" (13 exx. MNHN); "mare entrée res. Cap C. 20.IX. 59" (1 ex. MNHN); "CPr. Gordon's Bay/23.IX. 1959" (4 exx. MNHN); "CPr. Gordon's Bay mare" (4. exx. MNHN); "CPr./Pringle Bay 23.IX. 1993" (1 ex. MZH); "Philadelphia 18.XI 1949/*C. hottentotus* G. & H. det. J. Balfour-Browne -69" (1 ex. CAS); "Milnerton 10 mi N of C Town 18-20.XI. 1949" (7 exx. CAS); "CPr. 2 mi SW Citrusdal 30.IV. 58, 150 m/*C. hottentotus* G. & H. det. Omer-Cooper" (2 exx. CAS); "WC 10.IX. 2003, 342702S-201051E, rd Ouplas to Bredasdorp, Turner, Mann, Reavell leg." (3 exx. CTP); "WC, Bainskloof Pass 24.XII.-8.I. 2002, about 33.38S-19.10E, waterfall" (1 ex. NMW); "CPr. Karroo NP 32,19S/22,30E, 13.XI. 1993, pond & shore" (1 ex. MNB); "CPr. Somerset West 28-29.XII. 91/marshy area near Firgrove/*C. hottentotus* Gemm. & Har. det. Mazzoldi" (2 exx. CNU, 1 ex. CRF); "CPr. 4 mi S Barrydale 25.IV. 58, 375 m" (1 ex. CAS); "WC 4.IX. 2003, 334940S-205337E alt. 386 m, Riv. E Barrydale, Turner, Mann, Reavell leg." (3 exx. CTP); "CPr. Franschhoek Bosreserve Upper Berg Riv. 1.XI. 50" (1 ex. LUZ); "CPr. Cape Peninsula Cape Point Nat. Res. 10.XII. 50" (1 ex. LUZ); "WC, 30.VIII. 2003, 341436S-182306E, alt. 13 m, Groot Rondevlei, Cape Point Res." (2 exx. CTP); "CPr Cape Peninsula, Vlei 3 mi NE Kommetjie 24.X. 50" (1 ex. LUZ); "CPR. Swellendam Buffeljagsriv. 8.I. 51" (1 ex. LUZ); "WC 10.IX. 2003, 341856S-193554E, alt. 122 m, reservoir on R316 ca. 20 km S Caledon, Turner, Mann, Reavell leg." (1 ex. CTP); "W Cape, pond beside Bree Riv. In Mitchell's Pass, Ceres, Sept. 2002" (1 ex. CBT); "Cap b. sp." (44 exx. RMS); "Novara/*C. hottentotus* G. & H. det. Wewalka 79" (5 exx. NMW). PROVINCE UNCERTAIN: "Afr. Australe/*H. advena* Sharp det. Sharp" (2 exx. ISN); locality unknown: "*C. hottentotus* Gemm." (8 exx. ISN). UNCERTAIN RECORD: "Natal" (1 ex. BMNH). In all, 569 specimens studied.



**DIAGNOSIS.** A distinct species, distinguished from other *Canthyporus* species by general punctures of elytra: single punctures distinctly elongated, and by shape of penis: dorsal process almost as long as penis apex and almost parallel to it; in addition penis apex hooked (lateral aspect).

**DESCRIPTION.** Body. Length 2.48-2.88 mm, width 1.28-1.56 mm. Lateral outline of body evenly curved. Dorsal aspect with partly diffuse colour pattern (fig. 107).

**Head.** Blackish to dark ferrugineous, anteriorly with narrow and vague pale ferrugineous area. Between eyes evenly curved. Frontal depressions distinct, although rather shallow. Punctuation fine to very fine, dense. At inner margin of eyes, a row of punctures. Submat, finely reticulated. Antenna moderately long, rather slender; segments 1-4 pale ferrugineous, segments 5-11 brownish.

**Pronotum.** Lateral outline slightly and evenly curved. Pale ferrugineous, medially with a broad dark ferrugineous to blackish area, which anteriorly continues as a narrow area along frontal edge. Punctuation medially fine to very fine, slightly sparse; laterally punctures coarser and somewhat irregular. At margins, a row of slightly coarser punctures. Slightly mat, finely reticulated.

**Elytra.** Pale brown to dark brown, with somewhat vague paler markings (fig. 107). Punctuation rather fine and dense, slightly irregularly distributed. Each puncture somewhat longitudinally extended. Discal row of punctures clearly discernible, although partly hidden by adjacent punctures. Other rows of punctures indistinct, mixed with ordinary punctuation. Rather shiny, surface with very fine, partly indistinct reticulation. Epipleuron pale ferrugineous. Punctuation indistinct and reticulation very fine.

**Ventral aspect.** Black to blackish ferrugineous, apex of abdomen somewhat paler, ferrugineous. Prothorax pale ferrugineous to ferrugineous. Apex of prosternal process moderately elevated, somewhat enlarged, laterally beaded. Medial surface of apex almost flat, finely punctate. Punctuation of ventral aspect fine and sparse, partly indistinct. Rather shiny, abdomen with rather regular reticulation. Meshes of reticulation on metacoxal plates longitudinal. Metasternum rather shiny, reticulation strongly obliterated and almost absent.

**Legs.** Pale ferrugineous to ferrugineous. Pro- and mesotarsi somewhat enlarged.

**Male.** Genitalia as in figs 108-110.

**Female.** Pro- and mesotarsi slightly narrower than in male. Spermathecal tract as in fig. 111.

**DISTRIBUTION.** South Africa (Eastern Cape, Northern Cape, Western Cape) (fig. 175).

**BIOLOGY.** According to label information, the species lives in both running and stagnant water. The species has also been collected in a marshy area. Various water plants have been recorded at localities where *C. hottentottus* has been collected. The species is known from high altitudes, 1050-1070 m a.s.l. (for details and additional information, see above under "Additional material studied"). Turner et al. collected the species e.g. in a stream running through a forest and a slow-flowing and silty river with a sandy/rocky bottom and emergent vegetation. Also collected from a sandy roadside reservoir with some vegetation, from rain-supported pools with saline splash, from pools surrounded by reeds on a sandy substrate, and from a stream surrounded by *Phragmites* and at margins with silty, grassy flood pools. Finally, collected in a seasonal pool with fibrous vegetation,



sedge, and Proteacea surrounding the pool and from a slightly saline waterbody with a silty bottom.

*Canthyporus hynesi* Nilsson (figs 112-115, 171)

*Canthyporus hynesi* Nilsson, 1991:183 (orig. descr.): 2001:146 (cat.); Nilsson & Persson, 1993:60 (faun.).

TYPE LOCALITY. Ethiopia, Shewa Province, tributary to Dima River.

TYPE MATERIAL. Holotype ♂ deposited in MZH: "Ethiopia Shoa Dima R., trib. 20.XI. 1983 leg. HBN Hynes/38,45,5E – 09,07N/2850 m a.s.l./Holotype *Canthyporus hynesi* Nilsson 1989". Paratypes: same information as holotype but labelled as "Paratypus" (1 ex. MZH, 1 ex. CNU). In all, three specimens studied.

DIAGNOSIS. Resembles *C. loeffleri*, but the contrast between the main colour of the pronotum and elytra less distinct in *C. hynesi*. In addition, *C. hynesi* has a comparatively robust and curved dorsal process of the penis, while the process in *C. loeffleri* is small and only slightly curved apically.

DESCRIPTION (only relevant differences from *C. loeffleri* given). Body. Length 2.08-2.20 mm, width 1.18-1.24 mm. Colour pattern moderate, not pronounced (fig. 112).

Head. An indistinct frontomedial impression may be discernible in one of the examined specimens. At inner margin of eye, a few scattered punctures.

Pronotum. Blackish brown to dark brown, laterally and posteriorly with a narrow paler (pale ferrugineous to ferrugineous) area.

Elytra. At suture, punctures almost absent; a few hardly visible punctures may be discerned. Epipleuron finely reticulated, almost impunctate.

Ventral aspect. Metasternum and metacoxal plates blackish brown, other parts paler, brown to pale ferrugineous. Prosternal process moderately elevated, apex enlarged, laterally margined, and medial area impunctate and slightly convex. Process situated in a metasternal impression. Almost impunctate. Rather shiny, although distinctly reticulated. Metasternum at midline lacks additional lines (continuations of metacoxal lines).

Legs. Pro- and mesotarsi slightly enlarged and almost equally broad.

Male. Genitalia as in figs 113-115. Penis partly broken. Paramere drawn, using illustration in original description.

Female. Externally almost as male. In the single female examined, no sclerotized spermatheca was detected.

DISTRIBUTION. Ethiopia (Shewa) (fig. 171).

BIOLOGY. Collected at an altitude of 2850 m a.s.l. in a 1- to 2 m-wide tributary in a forest. See Nilsson (1991) for further details.

*Canthyporus kenyensis* Bilardo & Sanfilippo (figs 116-120, 171)

*Canthyporus kenyensis* Bilardo & Sanfilippo, 1979:88 (orig. descr.): Wewalka, 1981:60 (descr.); Leonardi et al., 1995:185 (type material); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. Kenya, Mount Kenya.

TYPE MATERIAL. Holotype ♂ deposited in MCG: "M.te Kenia met. Station Q 3050, 22-IX-76 N. Sanfilippo/*Canthyporus keniensis* Bil. & Sanf. Holotypus". Paratypes: same as holotype but labelled



“female/Allotypus” (1 ex. MCG); same as holotypus but labelled “Paratypus” (2 exx. MCG, 1 ex. MCM, 1 ex. CFB, 1 ex. CRF).

ADDITIONAL MATERIAL STUDIED. KENYA: “Mt. Kenya north. Halltarn > 4000 m, 2.XII. 1960/Moss at shore leg H. Löffler” (4 exx. NMW); “Mt Kenya Hooktarn < 4000 m leg. H. Löffler XII. 1960” (2 exx. NMW). In all, 13 specimens studied.

DIAGNOSIS. *Canthyporus kenyensis* is a distinct and characteristic species. The body is elongate and the penis is in dorsal view slender, and in lateral view the apex is distinctly curved upwards. The dorsal process is broad at the base and apically hook-shaped.

DESCRIPTION. Body. Length 2.72-3.00 mm, width 1.24-1.40 mm. Somewhat elongate. Blackish ferrugineous to brown to pale ferrugineous. Dorsal colour pattern somewhat indistinct and vague (fig. 116).

Head. Dark brown to dark ferrugineous, anteriorly with a rather narrow pale ferrugineous area. Frontal outline almost evenly curved, medially slightly straighter. Anteromedially, with two minute but distinct impressions. Frontal depressions extensive but shallow and vague. At inner margin of eyes, a shallow punctate furrow. Very finely and somewhat sparsely punctate. Submat, distinctly reticulated. Antenna rather slender, segments 3-10 a little longer than broad. Segments 1-4 pale ferrugineous, segments 5-11 in part brownish.

Pronotum. Pale ferrugineous to ferrugineous, with a vague blackish to dark ferrugineous marking. Lateral outline evenly curved. Punctuation very fine, sparse. At margins, irregular row of punctures. Submat, rather distinctly reticulated.

Elytra. Dark brown to brown, often with vague pale ferrugineous markings (fig. 116). Elytral colour pattern sometimes hardly visible and elytra almost unicoloured brownish. At suture, a sparse row of slightly coarser punctures. Discal row of punctures anteriorly distinct although, slightly irregular, posteriorly becomes somewhat irregular. Dorsolateral and lateral row of punctures sparse and irregularly distributed. Submat, distinctly reticulated; elytra posteriorly somewhat shiny. Epipleuron pale ferrugineous to brownish, impunctate, finely reticulated.

Ventral aspect. Blackish ferrugineous to dark brown, abdomen apically slightly paler. Prosternal process moderately elevated. Apex somewhat enlarged, laterally very finely beaded, with indistinct medial keel. Medial area of process impunctate but finely reticulated. Apex ends up in a metasternal impression. Almost impunctate, slightly mat due to fine reticulation. Metasternum at midline with rudimentary lines, which are difficult to discern.

Legs. Pale ferrugineous. Pro- and mesotarsi enlarged.

Male. According to original description, pro- and mesotarsi are broader in male than in female, but our studies do not unambiguously confirm this. Genitalia as in figs 117-119.

Female. Spermathecal tract as in fig. 120.

DISTRIBUTION. Kenya (Mt. Kenya) (fig. 171).

BIOLOGY. Sampled at altitudes from about 3000 m to more than 4000 m a.s.l.

*Canthyporus loeffleri* Wewalka (figs 121-124, 171)

*Canthyporus loeffleri* Wewalka, 1981:61 (orig. descr.): Nilsson, 1991:184 (disc.), 2001:146 (cat.); Nilsson & Persson, 1993: 60 (faun.).



TYPE LOCALITY. Ethiopia, Gondar, Simen Mountains, Jimbear Wenz.

TYPE MATERIAL. Holotype ♂ deposited in CWV: “Nord-Äthiopien Simen-Berge leg. Löffler 15.4. 76/Holotypus *Canthyporus loeffleri* n.sp. Wewalka 79/Coll. Wewalka”. In all, one specimen studied.

DIAGNOSIS. See diagnosis of *C. hynesi*.

DESCRIPTION. Body. Oval, rather small. Length 2.24 mm, width 1.28 mm. Pronotum a little darker than head and elytra; colour pattern moderately developed (fig. 121).

Head. Dark ferrugineous, anteriorly narrowly pale ferrugineous. Frontal outline between eyes curved. Minute frontomedial impressions absent. Frontal depressions with vague delimitation but still clearly discernible. At inner part of eyes anteriorly, a single coarse puncture; no furrow with punctures discernible at eyes. Ordinary punctation sparse, very fine and indistinct; partly absent. Rather shiny, although totally with distinct reticulation. Antenna with segments 1-4 pale ferrugineous; segments 5-11 brownish. Antenna of medium length; segments 5-10 approximately as long as broad.

Pronotum. Black, laterally with narrow, dark ferrugineous to ferrugineous areas. Lateral outline slightly curved. At margins, a sparse, somewhat irregular row of punctures. Ordinary punctation very fine, indistinct. Shiny, with very fine reticulation.

Elytra. Dark brown to brown, at suture slightly darker but without distinct colour pattern (fig. 121). A few scattered, fine punctures at suture. Discal row of punctures sparse, slightly irregular but discernible from base to apex. Dorsolateral and lateral rows of punctures also discernible from base to apex but distinctly sparser than discal row. Rather shiny, although finely reticulated. Apical region of elytron with slight depression, which posteriorly at hind margin of elytron forms a fine ridge. Epipleuron brown to dark brown.

Note: Ventral aspect, except abdomen, not personally studied because only available specimen mounted in water with non-soluble glue (large risk of injuring the holotype). According to original description, ventral aspect blackish-brown, finely reticulated and almost impunctate; meshes of reticulation on metacoxal plates elongate. Apex of prosternal process broad, obtuse, spoon-shaped.

Legs. Pale ferrugineous to ferrugineous. Protarsus somewhat enlarged, a little broader than mesotarsus.

Male. Genitalia as in figs 122-124; penis apex broken.

Female. Not examined. According to original description, pro- and mesotarsi narrower than in male.

DISTRIBUTION: Ethiopia (Gondar) (fig. 171).

BIOLOGY: Sampled at high altitude (3500 m a.s.l.).

### *Canthyporus lowryi* Omer-Cooper (figs 125-129, 173)

*Canthyporus lowryi* Omer-Cooper, 1965:155 (orig. descr.): Mazzoldi, 1997:604 (descr. female); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Cape Town, Sir Lowry's Pass.

TYPE MATERIAL. Lectotype ♂ in BMNH, by present designation: “Type male/ Syntype/ *Canthyporus lowryi* n.sp. Det. J. Omer-Cooper/ W. Cape Province Sir Lowry's Pass nr Somerset West i.XII. 1959 J. O. C./ Brit. Mus. 1978-308”. Paralectotypes: same data as lectotype, but labelled “Type female” (1 ex. BMNH); same data as lectotype, but labelled “Paratype” (1 ex. AMS).



ADDITIONAL MATERIAL STUDIED. South Africa: Western Cape: "C Pr. Theewaterskloof, Dam 31.XII. 1991/stream nr Theewaterskloof Dam/*C. lowryi* O-C. det. Mazzoldi -92" (1 ex. CRF). In all, four specimens studied.

DIAGNOSIS. See diagnosis of *C. angustatus*.

DESCRIPTION. Body. Quite broad, dorsoventrally slightly flattened. Colour pattern rather indistinct (fig. 125). Length 3.16-3.36 mm, width 1.68-1.72 mm (small specimen from Theewaterskloof length 2.88 mm, width 1.52 mm).

Head. Pale ferrugineous to ferrugineous, posteriorly with broad, vague, somewhat darker area. Frontal outline rounded. Frontally, in middle, two minute, rather indistinct, transverse impressions. Frontal depressions discernible but vague. Finely to rather finely and fairly densely punctate; punctation posteriorly sparser. Eyes at inner margin with a densely punctate shallow furrow. Submat, microsculptured. Antenna rather slender, basal segments pale ferrugineous; segments 5-11 apically somewhat darker.

Pronotum. Pale ferrugineous to ferrugineous, medially with a vague, dark ferrugineous marking which reaches both anterior and posterior edges. Lateral outline curved. Punctation fine and sparse, at margins, punctures distinctly denser. Submat, reticulated.

Elytra. Dark ferrugineous to dark brown, laterally paler. Colour pattern indistinct (fig. 125). Punctation fine to rather fine, fairly dense. Punctures in part slightly elongated in longitudinal direction. Discal row of punctures discernible but still rather indistinct because of adjacent punctation. Other rows of punctures mixed with ordinary punctation and not discernible. Finely reticulate, submat. Epipleuron pale ferrugineous to ferrugineous, reticulated, coarsely punctuate, but single punctures rather shallow.

Ventral aspect. Laterally blackish, medially dark ferrugineous to ferrugineous (change of colour vague), prothorax ferrugineous. Prosternal process moderately elevated, apex enlarged and laterally margined. Finely and sparsely punctate; extensively impunctate, but metacoxal plates with clearly discernible punctures. Finely reticulated; on metathorax and metacoxal plates meshes elongated, while less so on abdomen.

Legs. Pro- and mesotarsi enlarged. Metatibia (redrawn from original description) curved (fig. 126).

Male. Examined male in poor condition and earlier preparation of its genitalia incomplete. Illustrations here redrawn from original description (figs 127-128).

Female. Pro- and mesotarsi moderately enlarged. Metatibia straight. Spermathecal tract as in fig. 129.

DISTRIBUTION. South Africa (Western Cape) (fig. 173).

BIOLOGY. Practically unknown.

### *Canthyporus pauliani* Guignot (figs 130-133, 171)

*Canthyporus pauliani* Guignot, 1951b:125 (orig. descr.): 1956:253 (faun.); 1959:421 (descr.); 1961:929 (faun.); Bertrand, 1963:437 (faun.); Wewalka, 1981:57 (faun.); Rocchi, 1991:85 (faun.); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. Madagascar, Mont Tsaratanana, Lac Combes.

TYPE MATERIAL. Syntypes: "Madagascar Mt. Tsaratanana lac Combes II-1951 -Paulian/ male/ Type/ *Canthyporus pauliani* Guign. Type male" (1 ♂ MNHN); "Madagascar Mt Tsaratanana lac Combes



2700 m II-1951/female/Allotype" (1 ex. MNHN). In all, two specimens studied.

DIAGNOSIS. A distinct species. Antenna shorter and elytral punctures less longitudinally stretched than in the two other species of the group. For separation from some other similar species, see diagnosis of *C. alpestris*.

DESCRIPTION. Body. Length 1.92-1.94 mm, width 0.94-0.96 mm. Somewhat elongate, lacks distinct colour pattern (fig. 130).

Head. Blackish to dark brown, anteriorly with narrow ferrugineous area. Anteriorly between eyes curved, medially slightly straightened. Anteriorly in middle with an indistinct transverse puncture. Frontal depressions shallow but discernible. Punctuation fine, sparse, partly indistinct. At eyes, with a row of punctures. Reticulated (meshes discernible) but still rather shiny. Antenna with segments 1-5 pale ferrugineous to ferrugineous, segments 6-11 ferrugineous to dark brown.

Pronotum. Blackish ferrugineous to dark ferrugineous; laterally pronotum becomes gradually slightly paler. Laterally finely margined, outline somewhat curved. At margins, with coarser punctures, discally broad area with fine and sparse punctuation. Rather shiny, although microsculptured.

Elytra. Black to dark ferrugineous, laterally slightly paler but without distinct colour pattern. Discal row of punctures quite distinct, dorsolateral and lateral rows of punctures somewhat irregular but still discernible. Ordinary punctures very fine to fine, sparse, and partly absent. Rather shiny, although finely reticulated. Epipleuron pale ferrugineous to ferrugineous, with a few punctures, reticulated.

Ventral aspect. Black to dark ferrugineous. Metacoxal process and prothorax (almost totally) pale ferrugineous to ferrugineous. Apex of prosternal process somewhat enlarged; laterally margined and medially with a slight, longitudinal keel. Punctures fine and sparse, partly lacking. Almost totally with reticulation but still rather shiny.

Legs. Pale ferrugineous to ferrugineous.

Male. Pro- and mesotarsi distinctly enlarged. Genitalia as in figs 131-133.

Female. Pro- and mesotarsi slightly narrower. Spermathecal tract not examined (only one female so far available for study).

DISTRIBUTION. Madagascar (Antsiranana) (fig. 171).

BIOLOGY. According to information on label sampled at relatively high altitude: 2700 m.

*Canthyporus petulans* Guignot (figs 134-138, 179)

*Canthyporus petulans* Guignot, 1951a:23 (orig. descr.): 1956:308 (faun.); 1959:421 (descr.); Omer-Cooper, 1962:293 (faun.), 1965:153 (faun.); Bertrand & Legros, 1967: 867 (faun.); Nilsson, 1991:187 (disc.), 2001:146 (cat.); Mazzoldi, 1997:602 (descr. female).

TYPE LOCALITY. South Africa, Western Cape, George, Montague Pass.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Montague Pass George 20:2:47. J.O.C./(?) *hot-tentotus*/ *Canthyporus petulans* Guign. Type male/ Dr. F. Guignot det. 1950 *Canthyporus petulans* Guign. Type/ Brit. Mus. 1956-157". Paratypes: "Montague Pass George/20:2:47. J.O.C./ Paratype/ *Canthyporus petulans* Guign. Paratype" (2 exx. MNHN).

Note. A paratype is labelled as male and the other as female; same text, but no indication of sex (1 ex. AMS).

ADDITIONAL MATERIAL STUDIED. LESOTHO: "Drakensbg Sani Pass Walley 29.39 S-29.12 E/8.III.



1976, E-Y 1953 water collection" (23 exx. TMP, 1 ex. MZH). SOUTH AFRICA: EASTERN CAPE: "CPr. Karreedouw, elev. 300 m 22.IV. 58" (1 ex. CAS); "ECPr. Humansdorp dist., stream (?) Humansdorp rd 6.IX. 1948" (1 ex. AMS); "ECPr. Humansdorp, Witte del Bosch, pool 3.IX. 55" (1 ex. AMS); "ECPr. Matatiele 4.V. 1956" (1 ex. AMS); "ECPr. Uniondale Prince Alfreds Pass 13.V. 1957" (1 ex. AMS); "ECPr. Adelaide 9.IX. 57" (3 exx. AMS); "ECPr. Uitenhage 11.V. 57" (1 ex. AMS); "ECPr. Katberg IX. 1943/*C. petulans* Guign. Det. Omer-Cooper" (1 ex. MCG). FREE STATE: "Ruisseau env. Ventersburg et Senekal 28.VIII. 54/*C. petulans* Guign. Det. Legros" (1 ex. MNHN). MPUMALANGA: "ECPr. Middleburg Compassberg 29.I. 1958" (1 ex. AMS). WESTERN CAPE: Same text as types but not designed as type material (1 ex. AMS); "Cape Town/*C. petulans* Guign. J. Balfour-Browne det. 1955" (1 ex. BMNH); "Cape Town" (1 ex. MNHN); "Cape-Cedarbg jeep-track 900 m, 32.28 S-19.15 E/8.XI. 1983, E-Y 2056 water pools" (29 exx. TMP, 4 exx. MZH); "CP Clanwilliam distr. Seder Berg 500-1100 m/humus under bushes and larger stones IV. 1962" (1 ex. TMP); "W Cape Cedarbg Pass 32.23ES-19.06E/2.IX. 79 from river bed" (1 ex. TMP); "NC, riv. Through Kromrivier Fm, Cedarberg Mntns, 12.II. 1997" (1 ex. CTP); "W Cape, pond, ca 20 km NE Clanwilliam, Cedarberg Mts, Sept. 2002" (3 exx. CBP); "SW Cape Elandsbay Forestry/28.VI-II. 81/ground trap with meat bait, 60 days" (1 ex. TMP); "S Cape Mt Helderfontain 1150 m, 33.55S-20.52E/31.X. 78 river stones" (2 exx. TMP); "SW Cape Limiet Berge 33.33S-19.07E/7.XI. 73 water coll. At 950 m" (1 ex. TMP); "SW Cape Hawaquas rad. tower 33.41 S-19.06/27.X. 1978, E-Y 1484 shore washing" (49 exx. TMP, 4 exx. MZH); "SW Cape Mts Hawequas SE, 1100 m, 33.41S-19.06E/5.XI. 73, water coll. In rapid" (4 exx. TMP); "near Wellington 300 ft. 10.VIII. 1954/deep dam pool with grass and *Juncus* edging/*C. petulans* Guign. J. Balfour-Browne det. 1962" (3 exx. BMNH); "WC, Bainskloof Pass 24.XII.-8.I. 2002, about 33.38S-19.10E, waterfall" (3 exx. MZH, 18 exx. NMW); "C Pr Bainskloof about 10 mi ENE Wellington 12.II. 1951/*C. petulans* Guign. Det. J. Omer-Cooper" (1 ex. LUZ); "SW Cape Bainskloof 33.30S-19.10E/10.XI. 73 shorewashing" (1 ex. TMP); "Kalabaskraal ca. 350 ft. 27.VII. 1954/roadside pond, much *Juncus* and *Nitella*/*C. petulans* Guign. J. Balfour-Browne det." (2 exx. BMNH); "near Paarl 420 ft. 10.VIII. 1954/small, shallow, muddy, ephemeral pool/*C. petulans* Guign. J. Balfour-Browne det. 1963" (2 exx. BMNH); same but sampled from "shallow weedy rivulet" and "det. 1962" (2 exx. BMNH); "C Pr. Du Toits Riv. Nr Franschoekpass, 450 m, 31.XII. 1991/*C. petulans* Guign. det. Mazzoldi" (4 exx. CRF); "C. Pr. Stellenbosch Distr./Fransh Hoek Great Berg Riv. 4.III. 1954/*C. petulans* Guign. J. Balfour-Browne det. 1955" (3 exx. BMNH); "CPr. Bainskloof 21.XI. -95/*C. petulans* Guign. Det. A. Nilsson -96" (6 exx. CNU); "CPr Franschoek Bosreserve Upper Berg River 1.X. 1950" (1 ex. LUZ); "CPr Skurftesberg, Alfreds berg Pass, NNW Ceres 12.II. 1951/*C. petulans* Guign. Det. Omer-Cooper" (52 exx. LUZ); same but "*C. hottentotus* G. & H. det. Omer-Cooper" (2 exx. LUZ); "WC Hex R. Mts 7 km SW Ceres, 33.23S-19.19E, 500 m NN, 25.II. 97" (3 exx. NMW); "WC 3.IX. 2003, 331027S-192328E, alt. 305 m, Touwsrivier road N Guydo Pass, Ceres, Turner, Mann, Reavell leg." (9 exx. CTP); "W Cape, pond beside Bree Riv. In Mitchell's Pass, Ceres, Sept. 2002" (4 exx. CBP); "W Cape, Sept. 2002, Michell's Pass below Ceres, seepages on rock face" (12 exx. CBP); "CPr. 2 mi SW of Citrusdal 30.IV. 58, 150 m/*C. petulans* Guignot det. Omer-Cooper" (17 exx. CAS, 1 ex. AMS); "WCPr. Stream with pools in pine wood, Caledon 18.IX. 47" (1 ex. AMS); "CPr Olifants Riv. At Citrusdal 7.XI. 1950" (1 ex. LUZ); "WC Du Toits Mts, 9 km SE Fransohhoek 33.55S-19.08E, 28.II. 97" (1 ex. NMW); "WC Du Toits Mts, 8 km SE Fransohhoek 33.55S-19.08E, 28.II. 97" (2 exx. NMW); "CPr. Du Toit's Kloof 22.XI. 49/under stones in tiny spring, among algae, in bottom gravel" (21 exx. CAS); "mare entree reserve Cap C 20.IX. 59" (1 ex. MNHN); "Paarl 16.X. 49/*C. petulans* Guignot det. J. Balfour-Browne -60" (1 ex. CAS); "CPr Gordon's Bay/20.IX. 59" (1 ex. MNHN); "CPr Stellenbosch Jonkershoek 4.II. 1951" (1 ex. LUZ); "WC Stellenbosch Mts, 10 km SE Stellenbosch, 33.56S-18.51E, Jonkrshoek 28.II. 97" (4 exx. NMW); "CPr Breede R/14.IX. 59" (2 exx. MNHN); "WC 3.IX. 2003, 333426S-190830E, alt. 285 m, Tweede campsite, R. Breede and tributary" (1 ex.



CTP); "SW Cape Dwarfsberge 34.02S-19.01E/15.XI. 73 river stone" (1 ex. TMP); "CPr Viloenspaspas 5 mi NNE Grabouw 11.II. 51/*C. petulans* Guign. Det. J. Omer-Cooper" (2 exx. LUZ); "Worcester Robertson 14.IX. 59" (4 exx. MNHN); "Kappr. 11/10 Worcester 1991 Cumberland Hotelpool 33,39S-19,26E/*C. hottentottus* Gemm. det. Borisch" (3 exx. RMS); "WC, 4.IX. 2003, 333705S-192145E, alt. 287 m, reservoir rd. N15 E Worcester, Turner, Mann, Reavell leg." (4 exx. CTP); "WC, pond at R315 ca. 10 km E Darling, Sept. 2002" (19 exx. CBP); "WC, 3.IX. 2003, 331027S-192328E, alt. 305 m, dam N Guydo pass on Touwsrivier rd." (11 exx. CTP); "C Pr. Theewaterskloof, dam 31.XII. 91/stream nr Theewaterskloof Dam/*C. petulans* Guign. Det. Mazzoldi" (4 exx. CRF); "CPr. Stream N L. Theewaterskloof, R321 to Villiersdorp 22.II. 1997" (1 ex. MZH, 2 exx. CTP); "CPr. IV. 1958/*C. petulans* Guignot det. Omer-Cooper" (2 exx. CAS); "Cape" (1 ex. MNHN). No exact location given on labels (3 exx. AMS). In all, 381 specimens studied.

**DIAGNOSIS.** A distinct species. For separation from similar species, see diagnoses of *C. alpestris*, *C. alvei*, and *C. consuetus*.

**DESCRIPTION.** Body. Length 2.36-2.88 mm, width 1.28-1.52 mm. Somewhat flattened, comparatively broad with lateral outline evenly curved. Dorsal appearance as in fig. 134 (only minor variation observed). In general, specimens from Lesotho seem to be smaller than specimens from Western Cape.

**Head.** Black to dark ferrugineous, frontally with narrow paler area. Frontal depressions clearly discernible but moderately deep. Frontal outline evenly curved. Frontally, in middle, minute, transverse furrow. Punctuation fine to very fine, quite dense, and evenly distributed. At inner margin of eyes, some coarser punctures forming an almost straight line. Dorsal surface clearly reticulated (meshes of microsculpture clearly discernible); head still rather shiny. Antenna quite slender; segments 1-4 pale ferrugineous, segments 5-11 brownish to dark ferrugineous with base paler.

**Pronotum.** Pale ferrugineous to ferrugineous, medially with broad black to blackish ferrugineous area (fig. 134). Laterally with fine bead. Pronotal outline moderately curved. Punctuation fine to very fine, fairly dense, almost evenly distributed. At anterior margin, slightly irregular row of somewhat coarser punctures, and at base, on both sides of midline, 4-5 coarser punctures. Dorsal aspect finely reticulated but still rather shiny (meshes of microsculpture clearly discernible).

**Elytra.** Brownish to dark ferrugineous, at suture and at base narrowly blackish. Discally with two hardly visible, often indistinct, longitudinal, darkened, narrow markings (fig. 134). Punctuation fine to very fine, fairly dense, and almost evenly distributed. Discal row of punctures consists of slightly coarser punctures; posteriorly row becomes rather indistinct. Dorsolateral row of punctures clearly discernible, although sparser and more indistinct. Lateral row of punctures discernible but rather irregular. Finely reticulated, still rather shiny. Meshes of microsculpture fine but generally discernible. Epipleuron pale ferrugineous to pale brown; almost impunctate.

**Ventral aspect.** Black to dark ferrugineous, thorax except for prosternal process, pale ferrugineous to ferrugineous. Apex of prosternal process flat, somewhat enlarged, and provided with dense longitudinal punctures. Lines at metasternum midline absent. Punctuation fine, sparse, irregularly distributed, partly absent. Rather shiny, widely with discernible reticulation.

**Legs.** Pale ferrugineous to ferrugineous.



Male. Pro- and mesotarsi somewhat enlarged. Genitalia as in figs 135-137.

Female. Pro- and mesotarsi narrower, only slightly enlarged. Spermathecal tract as in fig. 138.

DISTRIBUTION. South Africa (Eastern Cape, Free State, Mpumalanga, Western Cape), Lesotho (fig. 179).

BIOLOGY. Sampled e.g. from deep dam pool with grass and *Juncus* edging, from a roadside pond with dense *Juncus* and *Nitella* growth, and from a shallow weedy rivulet. In addition, in a tiny spring, among algae, and in bottom gravel. Turner collected the species e.g. in a shallow, fast-flowing stream with rocky riffles and slower pools with a sandy/silty substrate, and from a reservoir with reed beds and filamentous algae, a rocky bottom and silty margins. Moreover, he collected it in mountain fynbos and from a sandy-bottomed stream-fed dam. Bilton collected the species from seepages on rock face. Some additional but fragmentary information may be obtained from the section with studied material, above.

*Canthyporus planus* Omer-Cooper (figs 139-143, 174)

*Canthyporus planus* Omer-Cooper, 1965:149 (orig. descr.): Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, Western Cape, Swellendam.

TYPE MATERIAL. Holotype ♀ deposited in BMNH: "type/ Holotype/ *C. planus* n.sp./ W. Cape Province Swellendam, mountain stream 28.XI. 1959 J. O.-C./ Brit. Mus. 1978-308/ *Canthyporus planus* J. O.-C. female M.E. Bacchus det. 1978 Holotype".

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: "Langeberge Helderfont. 1150 m, 33.56 S-20.52E/9.3. 1979 EY: 1564 river stones leg. Endrödy-Younga/*C. planus* O.-C. det. O. Biström 1995" (1 ex. MZH, 2 exx. TMP). In all, four specimens studied.

DIAGNOSIS. See diagnosis of *C. turneri*.

DESCRIPTION. Body. Length 3.20-3.40 mm, width 1.72-1.88 mm. Broad, distinctly flattened. Colour pattern indistinct, body almost totally blackish to dark ferrugineous (fig. 139).

Head. Frontal outline curved. Frontal depressions, although rather shallow, clearly discernible. Punctuation, fine, dense, almost evenly distributed. At eyes, somewhat coarser punctures. Rather shiny, although entire dorsal aspect with distinct reticulation. Frontomedially with two minute, hardly discernible punctures. Antenna ferrugineous to dark ferrugineous, comparatively long and slender.

Pronotum. Black to dark ferrugineous, lateral margin paler, ferrugineous. Surface with four wide but vague depressions, two on each pronotal half (sometimes difficult to discern). Punctuation fine, dense. At margins, with slightly coarser but irregularly distributed punctures mixed with ordinary punctuation. Rather shiny, with scattered, very fine reticulation discernible on disc.

Elytra. Black to dark ferrugineous, without distinct colour pattern (fig. 139). Fine, dense, and evenly distributed punctuation. Sparse, somewhat coarser punctures form irregular discal, dorsolateral, and lateral rows of punctures. Epipleuron blackish ferrugineous to ferrugineous, finely and densely punctate; with hardly discernible reticulation.

Ventral aspect. Black to dark ferrugineous. Prosternal process moderately elevated, apex enlarged and laterally beaded; medial surface almost flat, finely and densely punctate. Dense and fine punctuation extensively distributed. Reticulation fine, appears scattered;



clearly discernible on abdomen. Metacoxal lines continue at midline on metasternum, and lines connected slightly posterior to laterally distinctly edged metasternal cleft.

Legs. Blackish ferrugineous to ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 140-142.

Female. Spermathecal tract as in fig. 143. Holotype used for the illustration; anatomical parts now mounted in euparal on a separate card on same pin as holotype.

DISTRIBUTION. South Africa (Western Cape) (fig. 174).

BIOLOGY. Sampled in a mountain stream.

*Canthyporus sigillatus* (Guignot) (figs 144-148, 171)

*Laccornis sigillatus* Guignot 1955:190 (orig. descr.).

*Canthyporus sigillatus* (Guignot, 1955): Wewalka, 1981:59 (n. comb.); Nilsson, 1991:187 (disc.), 2001:146 (cat.); Mazzoldi, 1997:618 (disc.).

TYPE LOCALITY. Democratic Republic of the Congo, Sud-Kivu, Uvira, Lac Lungwe.

TYPE MATERIAL. Holotype ♂ deposited in MAC: "Récolté dans petites mares à sphaignes/ I.R.S.A.C. -Mus. Congo Kivu: Terr. Uvira, Lac Lungwe 2700 m. III-1953 G. Marlier L30/ Type/R. Det. 6649 L.L./ Guignot det. 1954 *Laccornis sigillatus* n.sp. Type male/ *Canthyporus sigillatus* (Guignot) nov. comb. Wewalka 1979". Paratype: principally with same data as holotype, but labelled as "Allotypus female" (1 ex. MAC). In all, two specimens studied.

DIAGNOSIS. A distinct, large species, which is particularly characterized by a peculiarly shaped penis. Dorsal process of penis large and located close to apex of penis; in other *Canthyporus* species, the process (if present) is located between base and middle of penis. Most similar to *C. subparallelus*, the male of which unfortunately is unknown. These two species are of different size, *C. subparallelus* being less than 3 mm in length, while *C. sigillatus* is clearly more than 3 mm. See also diagnosis of *C. pauliani*.

DESCRIPTION. Body. Length 3.24-3.40 mm, width 1.56-1.60 mm. Comparatively robust, body slightly elongated. Black to dark ferrugineous, with ferrugineous to pale ferrugineous, slightly variable markings (fig. 144).

Head. Dark ferrugineous, anteriorly with a narrow, pale ferrugineous area. Frontal outline between eyes curved. Minute frontomedial impressions. Frontal depressions shallow, with vague delimitation. At inner margin of eyes, a distinct row of punctures. Frontal depressions with a few slightly coarser and denser punctures. Ordinary punctation fine and somewhat sparse. Submat, distinctly reticulated. Antenna rather slender, segments 1-4 pale ferrugineous, segments 5-11 somewhat darker and longer than broad.

Pronotum. Black to dark ferrugineous, laterally with extensive and slightly vague ferrugineous to pale ferrugineous markings. Lateral outline strongly curved. Along margins, irregular coarse punctures. Ordinary punctation sparse and somewhat irregular; most punctures longitudinally slightly extended. Submat, distinctly reticulate.

Elytra. Black to dark ferrugineous, laterally slightly paler, but distinct colour pattern absent. Discal, dorsolateral, and lateral rows of punctures discernible but mixed with ordinary punctation and therefore in part rather indistinct. Ordinary punctation fairly coarse, dense, extensively distributed; some punctures longitudinally extended and confluent with adjacent punctures (form short furrows). Rather shiny, although distinctly reticulate. Apex



of elytron with a slight but clearly discernible depression. Epipleuron dark brownish to ferrugineous, basally with a few punctures, finely reticulated.

Ventral aspect. Black to dark ferrugineous, prosternum in part ferrugineous. Prosternal process moderately elevated, apex somewhat enlarged and laterally beaded. Ventral surface of apex almost flat and finely punctate. Apex located in a metasternal impression. Metasternum lacks lines along midline. Punctuation absent or indistinct; metacoxal plates with a few fine punctures; slightly mat, with distinct reticulation. Apex of apical sternite at least in female broadly obtuse and at apical margin with a fine but distinct furrow (characters not known in male because studied male with apical sternite broken).

Legs. Ferrugineous to pale ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 145-147.

Female. Externally as male. Spermathecal tract as in fig. 148.

DISTRIBUTION. Democratic Republic of the Congo (Sud-Kivu) (fig. 171).

BIOLOGY. Sampled in a small pool at relatively high altitude (2700 m a.s.l.).

*Canthyporus subparallelus* Guignot (figs 149, 171)

*Canthyporus subparallelus* Guignot, 1956:253 (orig. descr.): Bilardo & Sanfilippo, 1979:89 (disc.); Wewalka, 1981:59 (descr.); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. Democratic Republic of the Congo, Sud-Kivu, Mont Muhi.

TYPE MATERIAL. Holotype ♀ deposited in MAC: "Holotypus/ Type/ I.R.S.A.C. –Mus Congo Kivu Mont Muhi 3000 m (mare) G. Marlier 30-VII-1955/ Guignot det. 1956 *Canthyporus subparallelus* n.sp. Type female". In all, one specimen studied.

DIAGNOSIS. See diagnoses of *C. pauliani* and *C. sigillatus*.

DESCRIPTION OF FEMALE. Body. Length 2.64 mm, width 1.32 mm, slightly elongated. Colour pattern discernible, but markings vaguely delimited (fig. 149).

Head. Dark ferrugineous, frontally rather narrowly pale ferrugineous. Frontal outline between eyes curved. Frontomedial impressions minute but clearly discernible. Frontal depressions discernible but shallow and vague. Punctuation fine, somewhat sparse, rather indistinct due to distinct reticulation. At inner margin of eye, a fine, punctuate furrow. Antenna slender, segments 1-4 pale ferrugineous, segments 5-11 brownish. Segments 4-10 a little longer than broad.

Pronotum. Dark ferrugineous and brownish, laterally with a broad but vaguely delimited pale ferrugineous area. Lateral outline of pronotum curved. At margins, a slightly irregular row of coarser punctures. Ordinary punctuation fine, slightly sparse, and irregularly distributed. Submat, with distinct reticulation.

Elytra. Dark brown to dark ferrugineous, laterally slightly paler, with vague pale ferrugineous area (fig. 149). Discal row of punctures at base distinct, although slightly irregular. Sutural, dorsolateral, and lateral rows of punctures sparse and irregular but clearly discernible. Between rows, scattered coarser punctures. Ordinary punctuation fine, rather sparse, and evenly distributed. Submat, distinctly reticulate. Epipleuron pale ferrugineous to ferrugineous, indistinctly punctate but rather shiny, although with fine reticulation.

Ventral aspect. Black to dark ferrugineous, main part of prothorax and abdomen apically paler; ferrugineous to pale ferrugineous. Prosternal process moderately elevated. Apex



somewhat enlarged, laterally finely beaded, medial surface slightly convex and distinctly reticulated. Apex of process located in metasternal impression. Metacoxal plates with fine, sparse punctures, otherwise ventrally almost impunctate. Rather shiny, although finely reticulate. Metasternum lacks longitudinal lines at midline.

Legs. Pale ferruginous to ferruginous. Pro- and mesotarsi somewhat enlarged.

Male. Unknown.

Female. Spermathecal tract not located in the single examined specimen, which had earlier been dissected.

DISTRIBUTION. Democratic Republic of the Congo (Sud-Kivu) (fig. 171).

BIOLOGY. Sampled at high altitude.

*Canthyporus swaziensis* Omer-Cooper (figs 150-154, 171)

*Canthyporus swaziensis* Omer-Cooper, 1956:308 (orig. descr.): 1958:57 (faun.), 1962: 296 (faun.), 1964:377 (descr.); 1965:154 (faun.); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. Swaziland, Stegi.

TYPE MATERIAL. Holotype ♂ deposited in BMNH: "Type/ Swaziland, muddy pond nr. Stegi 4.12. 1948 J.O-C./ Brit. Mus. 1957-660/*Canthyporus swaziensis* O-C. det. J. Omer-Cooper".

ADDITIONAL MATERIAL STUDIED. ZIMBABWE: "Inyanga XI. 1948" (7 exx. AMS); "Inyanga Nyawere Bridge 14.III. 1948" (1 ex. AMS). SOUTH AFRICA: EASTERN CAPE: "ECPr Qumbu ca. V. 1956" (2 exx. AMS); "Engcobo 11.V. 1956" (1 ex. AMS; listed in original description but not indicated as type material). In all, 12 specimens studied.

DIAGNOSIS. A distinct species, with a characteristic penis shape; dorsal process slightly curved and located close to base of penis.

DESCRIPTION. Body. Length 2.60 mm, width 1.40 mm. Oval, lateral outline almost evenly curved. Dorsal colour pattern partly vague (fig. 150).

Head. Blackish ferruginous to dark ferruginous, frontally with narrow vague slightly paler area. Frontal outline curved; outline medially slightly straighter. Minute mediofrontal impressions almost absent (present but hardly discernible). Frontal depressions vague. Punctuation fine to very fine, somewhat sparse. At inner margin of eye, a row of slightly coarser punctures. Rather shiny, although finely reticulated. Antenna pale ferruginous, segments 5-11 pale brownish.

Pronotum. Pale ferruginous, with extensive blackish to dark ferruginous marking. Lateral outline slightly curved. Punctuation very fine, sparse, partly indistinct. Very finely reticulated.

Elytra. Pale ferruginous to ferruginous, with vague dark ferruginous to blackish ferruginous marking (fig. 150). Punctuation fine to very fine, rather sparse, and irregularly distributed, partly indistinct. Discal row of punctures discernible but slightly irregular and mixed with ordinary punctures. Dorsolateral and lateral rows of punctures indistinct. Rather shiny, although finely reticulated.

Ventral aspect. Blackish to dark ferruginous, except prosternum pale ferruginous to ferruginous. Prosternal process moderately elevated, apex somewhat enlarged, laterally beaded. Medial surface of apex slightly convex, sparsely and finely punctate. Otherwise almost impunctate with few scattered punctures discernible. Rather shiny, although extensively with fine reticulation. Metasternum lacks longitudinal lines at midline.



Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 151-153.

Female. Externally as male. Spermatheca illustrated from an earlier dissected, broken specimen (fig. 154).

DISTRIBUTION. South Africa (Eastern Cape), Swaziland (Lubombo), Zimbabwe (fig. 171).

BIOLOGY. According to Omer-Cooper (1964), species collected in a swift stream between steep rocky banks and marshy ground and in a bog. Holotype collected in a muddy pond.

***Canthyporus turneri* n. sp.** (figs 155-158, 174)

TYPE LOCALITY. South Africa, Western Cape, Swartberg Pass.

TYPE MATERIAL. Holotype ♂ in SAM: "35, W Cape South Africa 5.IX. 2003, C.R. Turner, D.J. Mann & P. Reavell 3321107S, 220246E, alt. 1497 m, first stream as descend on North side of pass from top. Pools near roadside. Swartberg Pass". Paratype: same data as holotype (1 ♂ MZH). In all, two specimens studied.

ETYMOLOGY. Named in honour of Dr. Clive Turner, Plymouth, who collected the type material.

DIAGNOSIS. The new species resembles *C. planus*, from which it can be distinguished by its oval body shape (body of *C. planus* in part parallel-sided). Furthermore, *C. planus* has a penis apex curved upwards and the apical outline of the paramere is obtuse, whereas *C. turneri* has a straight penis apex and apical outline of the paramere is evenly curved.

DESCRIPTION OF MALE (only relevant differences from *C. planus* given). Body. Oval, dorsoventrally somewhat flattened (fig. 155). Almost unicoloured black; pronotal margins with slightly paler areas. Length of body 3.00-3.12 mm, width 1.72-1.80 mm.

Pronotum. Surface with vague depressions.

Elytra. Punctures slightly extended in longitudinal direction. Rows of punctures indistinct, mixed with ordinary punctation. Epipleuron with dense but indistinct punctation.

Ventral aspect. Prosternal process slightly elevated, apex enlarged and laterally finely beaded. Medial area of process apex almost flat and punctate, but extreme apex lacks punctures. Apex situated in metasternal impression.

Legs. Pale ferrugineous to ferrugineous, metatibia in part dark ferrugineous.

Male. Genitalia as in figs 156-158.

Female. Unknown.

DISTRIBUTION. South Africa (Western Cape) (fig. 174).

BIOLOGY. Collected in pools of a mountain stream, at an altitude of almost 1500 m.

Group *lateralis*

This group includes three South African species (*C. regimbarti* only tentatively placed in this group as male genitalia unknown) sharing a comparatively large-sized, robust body and a similar elytral colour pattern: at base black to dark brown, immediately followed by a distinctly delimited, transversely extended pale marking. The genitalia in this group are simple in the males, whereas the females have an extended spermathecal tract with a loop.



*Canthyporus bicinctus* (Régimbart) (figs 159-163, 174)*Hydroporus bicinctus* Régimbart, 1895:31 (orig. descr.).*Canthyporus bicinctus* (Régimbart, 1895): Zimmermann, 1919:160 (list.), 1920:133 (cat.); Omer-Cooper, 1955:189 (descr.), 1962:296 (faun.), 1965:150 (descr., faun.); Guignot, 1959:417 (descr.); Nilsson, 2001:145 (cat.).

TYPE LOCALITY. South Africa, 'Cap'.

TYPE MATERIAL. Holotype not located in ISN, sex unknown: "Cap, collection Chevrolat".

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: "Cape Cederbg jeeptrack 900 m 32.28S-19.15E/8.XI. 1983 EY: 2056 water pools leg. Endrödy-Younga" (1 ex. MZH, 2 exx. TMP); "Montague Pass George/20.II. 47 J.O.C." (1 ex. AMS, 2 exx. MNHN); Same data but labelled "22.XI. 1947" (1 ex. AMS); WC 6.IX. 2003, 335441S-222515E, river nr George, alt. 325 m, Turner, Mann, Reavell leg. (1 ex. CTP). In all, eight specimens studied.

DIAGNOSIS. Within this group, *C. bicinctus* is easily distinguished by the coarse ordinary punctation of elytra (separate punctures are somewhat elongated) – in the two other species, ordinary punctation of elytra is fine, partly indistinct. See also diagnosis of *C. regimbarti*.

DESCRIPTION. Body. Length 3.00-3.36 mm, width 1.64-1.80 mm. Somewhat broad in shape. Colour pattern rather distinct and slightly variable (fig. 159).

Head. Black, anteriorly only slightly paler. Frontal outline curved. Frontally, in middle, two minute impressions. Frontal depressions discernible but vague and indistinctly delimited. Punctation very fine, sparse. At inner margin of eye, a row of punctures. In shallow frontal depressions, punctation denser and slightly coarser. Submat, reticulation distinct. Antenna rather slender. Segments 1-4 and basal part of segment 5 pale ferrugineous to ferrugineous, rest of segments dark.

Pronotum. Black, laterally with vague dark ferrugineous to ferrugineous areas. Lateral outline of pronotum almost evenly curved. Punctation fine to fairly fine, somewhat irregularly distributed; dense to somewhat sparse. At frontal margin and posteriorly, denser and slightly coarser punctures. Submat, with distinct reticulation.

Elytra. Black to dark brown, with pale ferrugineous to ferrugineous markings (fig. 159). Pale frontal area sometimes almost divided by darkened stripes. Discal row of punctures clearly discernible but somewhat irregular; posteriorly mixed with adjacent punctures. Dorsolateral row of punctures discernible but disappears both anteriorly and posteriorly. Lateral row of punctures consists of a few scattered punctures. Ordinary punctation fine to rather fine, somewhat irregularly distributed. Laterally indistinct. Most single punctures longitudinally slightly expanded. Submat, finely reticulated. Epipleuron pale ferrugineous, rather indistinctly punctate, submat, finely reticulate.

Ventral aspect. Black to dark ferrugineous, prothorax and apex of abdomen pale ferrugineous to ferrugineous. Apex of prosternal process only somewhat elevated. Apex somewhat enlarged, laterally margined. Medial surface of apex almost flat, densely punctate, partly wrinkled. Punctation of ventral aspect in general fine to very fine, irregular, partly dense, partly absent. Rather shiny, although finely and densely reticulated. Metacoxal plates with 5-6 shallow, almost transversely located furrows.

Legs. Pale ferrugineous to ferrugineous. Pro- and mesotarsi distinctly enlarged.

Male. Genitalia as in figs 160-162.



Female. Pro- and mesotarsi moderately enlarged. Spermathecal tract as in fig. 163.

DISTRIBUTION. South Africa (Western Cape) (fig. 174).

BIOLOGY. Turner sampled the species in a river, in indigenous forest riffles and pools near the bottom.

*Canthyporus lateralis* (Boheman) (figs 164-168, 173)

*Hydroporus lateralis* Boheman, 1848:255 (orig. descr.); Sharp, 1882:800 (descr.); Branden, 1885:55 (cat.); Zimmermann, 1919:160 (list, ?*Canthyporus*).

*Canthyporus lateralis* (Boheman, 1848): Zimmermann 1920:134 (n. comb.); Omer-Cooper, 1955:189 (descr., lectotype), 1962:296 (faun.), 1965:150 (faun.); Guignot, 1959:423 (descr.); Nilsson, 2001:146 (cat.).

TYPE LOCALITY. South Africa, "Caffraria interiore".

TYPE MATERIAL. Lectotype ♀ deposited in RMS: "Caffraria./ J. Wahlb./ Type/ Typus/ J. Balfour-Browne vid. T. 1956/ *Hydroporus lateralis* Boh./ 125 54/5577 E91/ Naturhistoriska Riksmuseet Loan no 97/03". Paralectotype: "J. Wahlb./ Caffraria/ J. Balfour-Browne vid. T. 1956/ *lateralis*/ Naturhistoriska Riksmuseet Loan no 98/03" (1 ♀ RMS).

ADDITIONAL MATERIAL STUDIED. SOUTH AFRICA: WESTERN CAPE: "Cape Kalk Bay 28.5. 1932 c. A. D. Harrison/Brit. Mus. 1956-157/*C. lateralis* Boh. Det. J. Omer-Cooper cf. with type" (1 ex. BMNH); "CPr Kalb Bay Peak 22.V. 52/*C. lateralis* Boh. det. Omer-Cooper" (2 exx. AMS); "Cape-Cedarbg, jeeptrack 900 m, 32.28S-19.15E/8.XI. 1983 water pools" (9 exx. TMP, 3 exx. MZH); "NC, Cedarberg Mntns, river through Kromrivier Fm Turner leg. 12.II. 1997" (1 ex. CTP); "CPr. Skurfteberg Alfreds Berg Pass NNW Ceres 12.II. 51/*C. lateralis* Boh. det. Omer-Cooper" (3 exx. LUZ); "W Cape Hawequas 33.34S-19.08E/6.XI. 73 from rock pools" (1 ex. TMP). In all, 22 specimens studied.

DIAGNOSIS. See diagnoses of *C. bicinctus* and *C. regimbarti*.

DESCRIPTION. Body. Length 2.64-3.36 mm, width 1.44-1.72 mm. Black to dark ferrugineous, with rather distinct colour pattern (fig. 164).

Head. Black, anteriorly sometimes blackish ferrugineous. Frontal outline between eyes curved. With minute, hardly discernible, frontomedial impressions. Frontal depressions rather shallow with vague delimitation; provided with a few dense punctures. At inner margin of eyes, a row of distinct punctures. Ordinary punctation very fine, somewhat sparse. Submat, distinctly reticulated. Antenna rather slender (segments slightly longer than broad), segments 1-4 pale ferrugineous, and segments 5-11 dark ferrugineous.

Pronotum. Black, laterally with vague, dark ferrugineous to ferrugineous areas. Lateral outline slightly curved. At margins, irregular coarse punctures. Ordinary punctation fine to very fine, fairly dense, almost evenly distributed. Submat, finely reticulated.

Elytra. Black to dark ferrugineous, with distinct pale ferrugineous markings (fig. 164). Discal row of punctures at base clearly discernible, although somewhat irregular; posteriorly indistinct or absent. Dorsolateral and lateral rows of punctures also discernible but sparser and rather indistinct. Ordinary punctation clearly discernible but fine to very fine and with slightly irregular distribution. Each puncture with symmetric shape or slightly longitudinally stretched. Submat, finely reticulated. Epipleuron ferrugineous, very finely punctate and reticulate.

Ventral aspect. Black to dark ferrugineous, prosternum mainly ferrugineous. Proster-



nal process moderately elevated, apex slightly enlarged and laterally finely beaded. Medial surface of process with longitudinal, somewhat indistinct keel. Finely to rather finely and densely punctate. Punctuation in part somewhat indistinct and irregular. Slightly mat, reticulation variable, in part rather indistinct.

Legs. Ferruginous to pale ferruginous. Pro- and mesotarsi slightly enlarged.

Male. Genitalia as in figs 165-167.

Female. Pro- and mesotarsi a little narrower than in male. Ordinary elytral punctures slightly coarser than in male. Spermathecal tract as in fig. 168.

DISTRIBUTION. South Africa (Western Cape) (fig. 173).

BIOLOGY. Almost unknown. Collected in rainwater pools and from rock pools. Turner collected the species in a river with silty areas and riffles, the margins of which were well vegetated (mountain fynbos).

*Canthyporus regimbarti* Nilsson (figs 169-170)

*Hydroporus luridipennis* Régimbart, 1895:31 (orig. descr.) (preocc. by Melsheimer, 1844).

*Canthyporus luridipennis* (Régimbart, 1895): Zimmermann, 1919:160 (n. comb.), 1920:134 (cat.); Guignot, 1959:422 (descr.); Omer-Cooper, 1962:296 (faun.), 1965:154 (faun.).

*Canthyporus regimbarti* Nilsson, 2001:146 (repl. name).

TYPE LOCALITY. South Africa, 'Cap'.

TYPE MATERIAL. Holotype ♀ deposited in ISN: "Cap Coll. Chevrolat det. Sharp 82/3100/ Sharp det., 1882 *Hydroporus luridus* Chev. (in litt!)/ rev. Régimbart *Canthyporus luridipennis* Rég./Type". In all, one specimen studied.

DIAGNOSIS. Although known only from a single female, *C. regimbarti* is evidently most similar to *C. lateralis*. The dark elytral colour pattern is extensive in *C. lateralis* and reduced in *C. regimbarti*. Moreover, the elytral microsculpture of *C. regimbarti* is denser and elytral punctuation therefore very fine, partly hardly discernible, while punctuation is distinct in *C. lateralis*. The spermathecal tract of the two species seems to be identical. See also diagnosis of *C. bicinctus*.

DESCRIPTION OF FEMALE. Body. Length 2.92 mm, width 1.60 mm. Oval, lateral outline evenly curved, unbroken. Dark colour pattern rather distinct; on elytra, however, reduced (fig. 169).

Head. Blackish to dark ferruginous, anteriorly a little paler. Frontal outline of head evenly curved. Frontally, in middle, with two minute impressions. Frontal depressions vague. At inner margin of eyes, a row of finer punctures. Punctuation fine to very fine (in part difficult to discern), fairly dense. Submat, reticulation dense and fairly distinct. Antennae broken, segments 6-11 totally missing; basal segments pale ferruginous, somewhat elongated.

Pronotum. Dark ferruginous, frontally at pronotum narrowly blackish; laterally with vaguely delimited pale ferruginous to ferruginous areas. Lateral outline almost straight, anteriorly more strongly curved inwards. At margins, a somewhat irregular row of fine but clearly discernible punctures. Ordinary punctuation fine to very fine, fairly dense. Submat, finely and densely reticulated.

Elytra. Pale ferruginous; at pronotum and along suture, slightly darker; ferruginous to dark ferruginous (colour pattern delimitation vague) (fig. 169). Rows of punctures in-



distinct, partly not discernible (vague fragments of puncture rows may be detected). Ordinary punctation fine to very fine, fairly dense. Size of single puncture varies so that finer and coarser punctures are somewhat irregularly distributed and appear mixed. Matt to shiny; extensively with dense reticulation. In frontal part of elytron and laterally slightly posterior to middle of elytron, reticulation is partly reduced and indistinct. Epipleuron pale ferrugineous to ferrugineous, finely and densely punctate, with indistinct reticulation.

Ventral aspect. Black, abdomen apically and prothorax laterally ferrugineous to dark ferrugineous. Punctation dense and fine to very fine. Slightly mat, finely and densely microsculptured. Additional lines at metasternal midline lacking. Prosternal process moderately elevated. Apex somewhat enlarged, laterally margined, and medial surface slightly convex and finely punctate. Apex situated in metasternal impression.

Legs. Pale ferrugineous to ferrugineous; femora basally darker. Protarsus slightly enlarged. Metatarsal claws reduced to two minute and short spines.

Male. Unknown.

Female. Spermathecal tract as in fig. 170.

DISTRIBUTION. South Africa ('Cap').

BIOLOGY. Unknown.

#### LIST OF SPECIES

##### Group *canthydroides*

- Canthyporus canthydroides* (Régimbart, 1895)
- = *Canthyporus laccophiloides* Omer-Cooper, 1953
- = *Canthyporus similator* Zimmermann, 1923
- = *Canthyporus simulator* Guignot, 1959
- Canthyporus congener* Omer-Cooper, 1956
- Canthyporus guignoti* Omer-Cooper, 1956
- Canthyporus guttatus* Omer-Cooper, 1956
- Canthyporus latus* Omer-Cooper, 1965
- Canthyporus navigator* Guignot, 1951
- Canthyporus nimius* Biström & Nilsson, 2006
- Canthyporus parvus* Omer-Cooper, 1955
- Canthyporus testaceus* Zimmermann, 1923
- Canthyporus wewalkai* Biström & Nilsson, 2006

##### Group *exilis*

- Canthyporus aenigmaticus* Biström & Nilsson, 2006
- Canthyporus brincki* Omer-Cooper, 1965
- Canthyporus exilis* (Boheman, 1848)
- Canthyporus nebulosus* Omer-Cooper, 1965

##### Group *hottentottus*

- Canthyporus alpestris* Guignot, 1936
- Canthyporus alvei* Omer-Cooper, 1965
- Canthyporus angustatus* Omer-Cooper, 1965



- Canthyporus consuetus* Omer-Cooper, 1965  
*Canthyporus cooperae* Guignot, 1951  
*Canthyporus fluviatilis* Omer-Cooper, 1956  
*Canthyporus hottentottus* (Gemminger & Harold, 1868)  
 = *Hydroporus collaris* Boheman, 1848  
 = *Hydroporus advena* Sharp, 1882  
*Canthyporus hynesi* Nilsson, 1991  
*Canthyporus kenyensis* Bilardo & Sanfilippo, 1979  
*Canthyporus loeffleri* Wewalka, 1981  
*Canthyporus lowryi* Omer-Cooper, 1965  
*Canthyporus pauliani* Guignot, 1951  
*Canthyporus petulans* Guignot, 1951  
*Canthyporus planus* Omer-Cooper, 1965  
*Canthyporus sigillatus* (Guignot, 1955)  
*Canthyporus subparallelus* Guignot, 1956  
*Canthyporus swaziensis* Omer-Cooper, 1956  
*Canthyporus turneri* Biström & Nilsson, 2006

#### Group *lateralis*

- Canthyporus bicinctus* (Régimbart, 1895)  
*Canthyporus lateralis* (Boheman, 1848)  
*Canthyporus regimbarti* Nilsson, 2001  
 = *Hydroporus luridipennis* Régimbart, 1895

#### ACKNOWLEDGEMENTS

The following colleagues are sincerely thanked for loan of material: Dr M. Baehr (München), Dr D.T. Bilton (Plymouth), Dr R. Danielsson (Lund), Dr D. Drugmand (Brussels), Dr H. Fery (Berlin), Dr Sibylle Gussmann (Pretoria), Dr M. Jäch (Vienna), Dr D.H. Kavanaugh (San Francisco), Dr M. de Meyer (Tervuren), Dr F. de Moor (Grahamstown), H. Perrin (Paris), Dr R. Poggi (Genova), Dr F. Rigato (Milano), S. Rocchi (Firenze), Dr H. Shaverdo (Vienna), Dr M. Schmitt (Bonn), Dr W.E. Steiner (Washington, DC), Dr C. Taylor (London), Dr C. Turner (Plymouth), Dr M. Uhlig (Berlin), B. Viklund (Stockholm), and Professor G. Wewalka (Vienna). Dr K.B. Miller, (Utah), is thanked to proving information on female genitalia of *Laccornellus*. Finally, C.A. Pelli (Helsinki) is thanked for linguistic revision of the manuscript.

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Table 1. Character matrix used in the parsimony analysis. See text for explanation of characters and states.

	00000	00001	11111	11112	22222	22223	33
Species	12345	67890	12345	67890	12345	67890	12
<i>Laccornis kocae</i>	00000	02000	00000	00000	00000	00000	00
<i>L. oblongus</i>	00001	00000	00001	00000	01000	01000	00
<i>Lacornellus lugubris</i>	00000	01000	00000	01000	01000	00000	11
<i>Canthyporus alpestris</i>	00001	01000	01100	00100	00121	00???	11
<i>C. alvei</i>	00000	01000	01100	00100	00111	00111	11
<i>C. angustatus</i>	00000	01000	01101	00211	00112	00???	11
<i>C. bicinctus</i>	00001	01011	01100	01100	01000	00111	11
<i>C. brincki</i>	10011	02000	01100	10100	11000	01???	11
<i>C. canthydroides</i>	00000	01000	01120	00100	01000	10000	11
<i>C. congener</i>	00000	01000	01120	00100	01000	10000	11
<i>C. consuetus</i>	00000	02000	01100	00200	00111	00111	11
<i>C. cooperae</i>	00000	01000	01100	00200	00111	00110	11
<i>C. aenigmaticus</i>	10011	02000	01100	10100	11000	01???	11
<i>C. exilis</i>	10111	02000	01100	10100	11000	01000	11
<i>C. fluviatilis</i>	00000	01000	01101	00211	00112	00110	11
<i>C. guignoti</i>	00000	01000	01120	00100	01000	10000	11
<i>C. guttatus</i>	00000	11000	11120	01200	01211	00000	11
<i>C. hottentottus</i>	00000	01001	01100	00200	01111	00111	11
<i>C. hynesi</i>	10011	02000	01100	00200	01121	00???	11
<i>C. kenyensis</i>	00001	11000	01100	00200	00121	00111	11
<i>C. lateralis</i>	00001	01010	01100	00100	00000	00111	11
<i>C. latus</i>	10100	12100	11120	01200	01000	10110	11
<i>C. loeffleri</i>	10011	02000	01100	10100	11121	00???	11
<i>C. lowryi</i>	00000	01001	01101	00201	00112	00111	11
<i>C. navigator</i>	00000	00000	01120	01100	01000	10000	11
<i>C. nebulosus</i>	10011	02000	01100	10100	11000	01000	11
<i>C. nimius</i>	00000	01000	01120	00100	00000	10000	11
<i>C. parvus</i>	00010	01001	01120	00200	01000	00000	11
<i>C. pauliani</i>	01011	01000	01100	00200	00111	00???	11
<i>C. petulans</i>	00000	02000	01100	00100	00121	00111	11
<i>C. planus</i>	10101	01000	01120	01100	00211	00110	11
<i>C. sigillatus</i>	01001	02001	01100	00200	01211	00111	11
<i>C. swaziensis</i>	00000	02001	01100	00100	00121	00111	11
<i>C. testaceus</i>	01010	00100	01110	01100	01000	10000	11
<i>C. turneri</i>	10101	01001	01120	01100	01211	00???	11
<i>C. wewalkai</i>	00000	01000	01120	00100	00000	10000	11



Fig. 1. One of 28 shortest trees found in NONA. Tree length 97, CI 0.39, and RI 0.76. Character codes (as in tab. 1) above branches refer to unique character state transformations (black dots) or homoplasious character state transformations (white dots). State codes are given below branches. Fast optimization was applied. Tree produced in WinClada (Nixon, 2002).

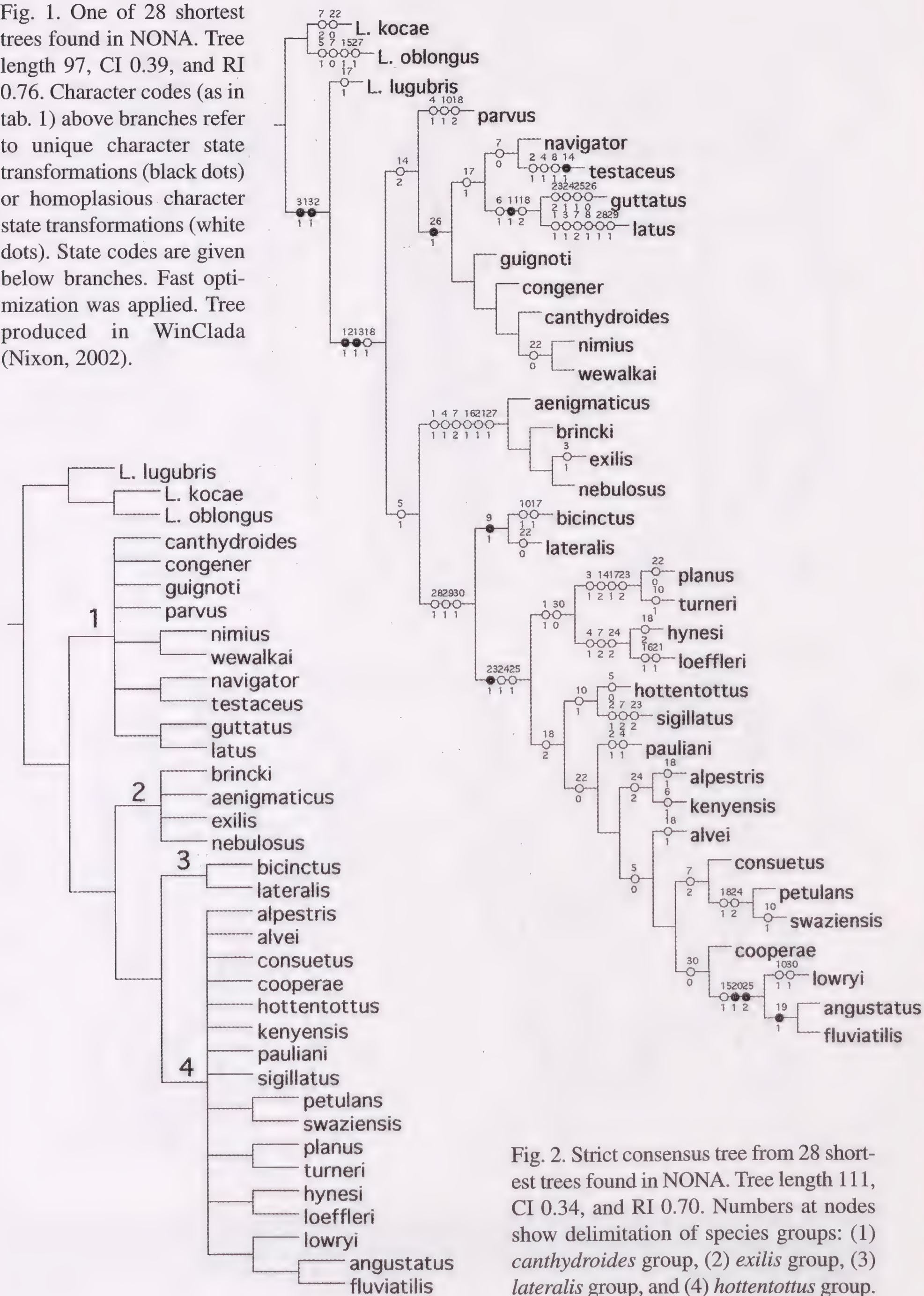
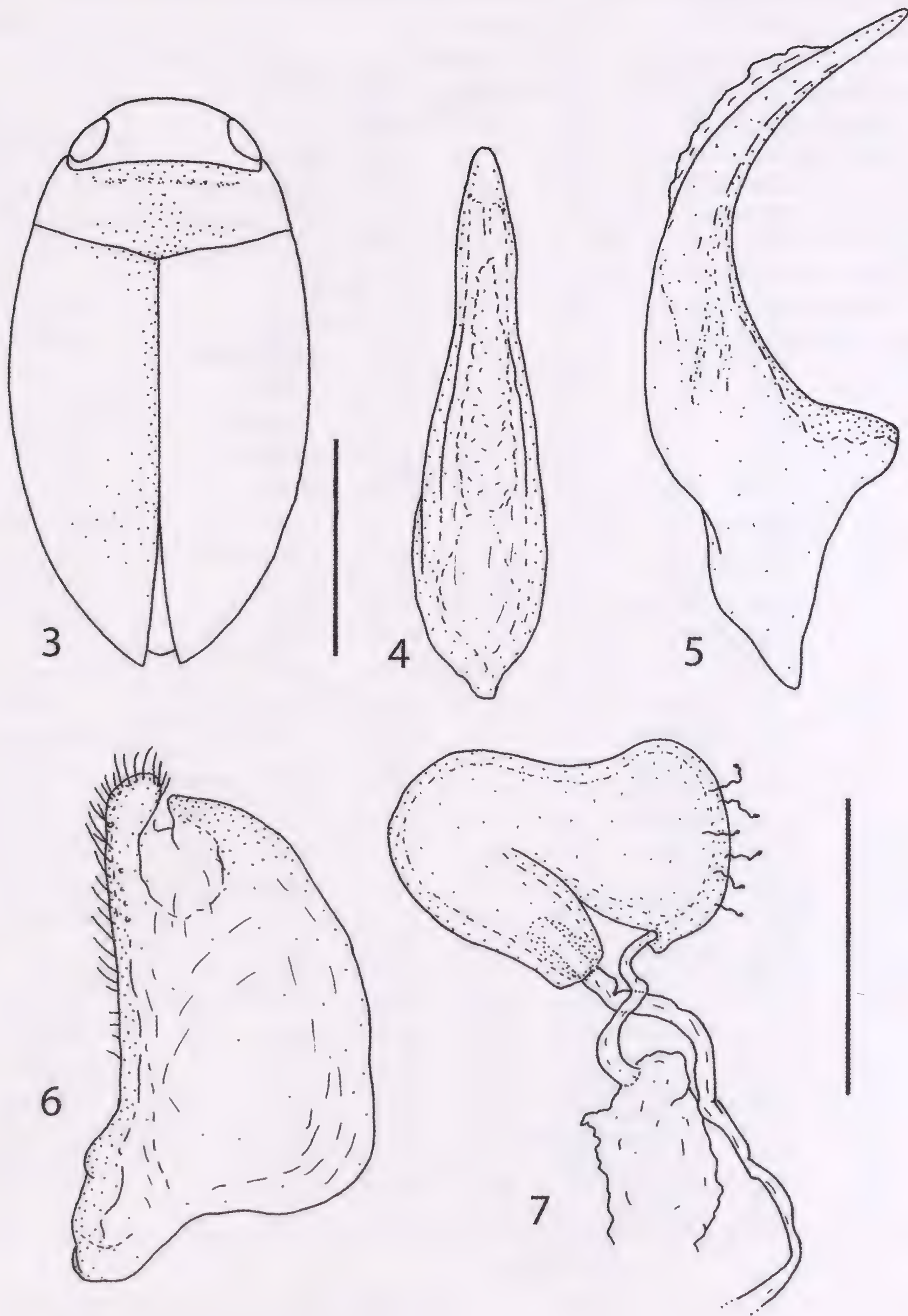


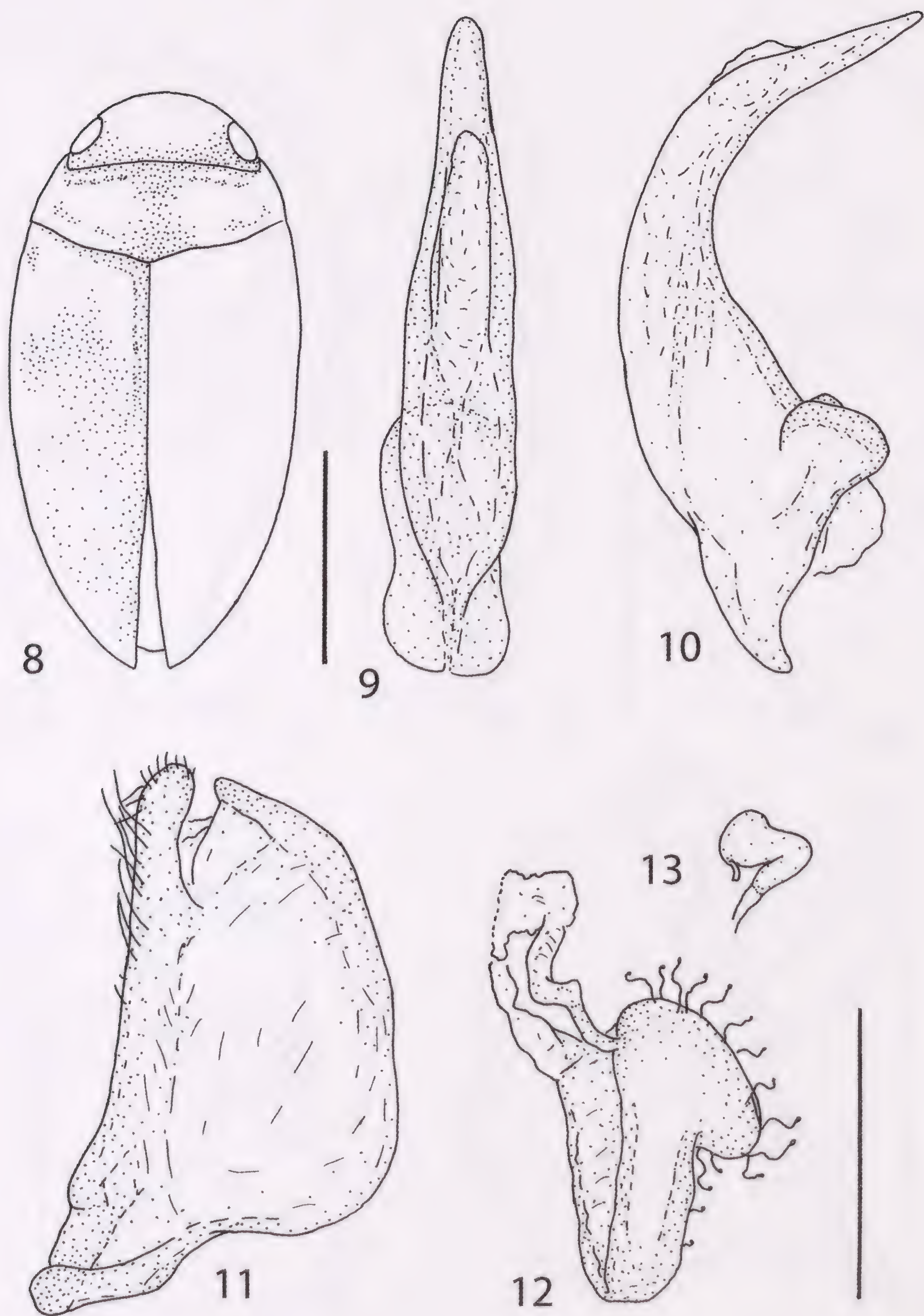
Fig. 2. Strict consensus tree from 28 shortest trees found in NONA. Tree length 111, CI 0.34, and RI 0.70. Numbers at nodes show delimitation of species groups: (1) *canthydroides* group, (2) *exilis* group, (3) *lateralis* group, and (4) *hottentottus* group.





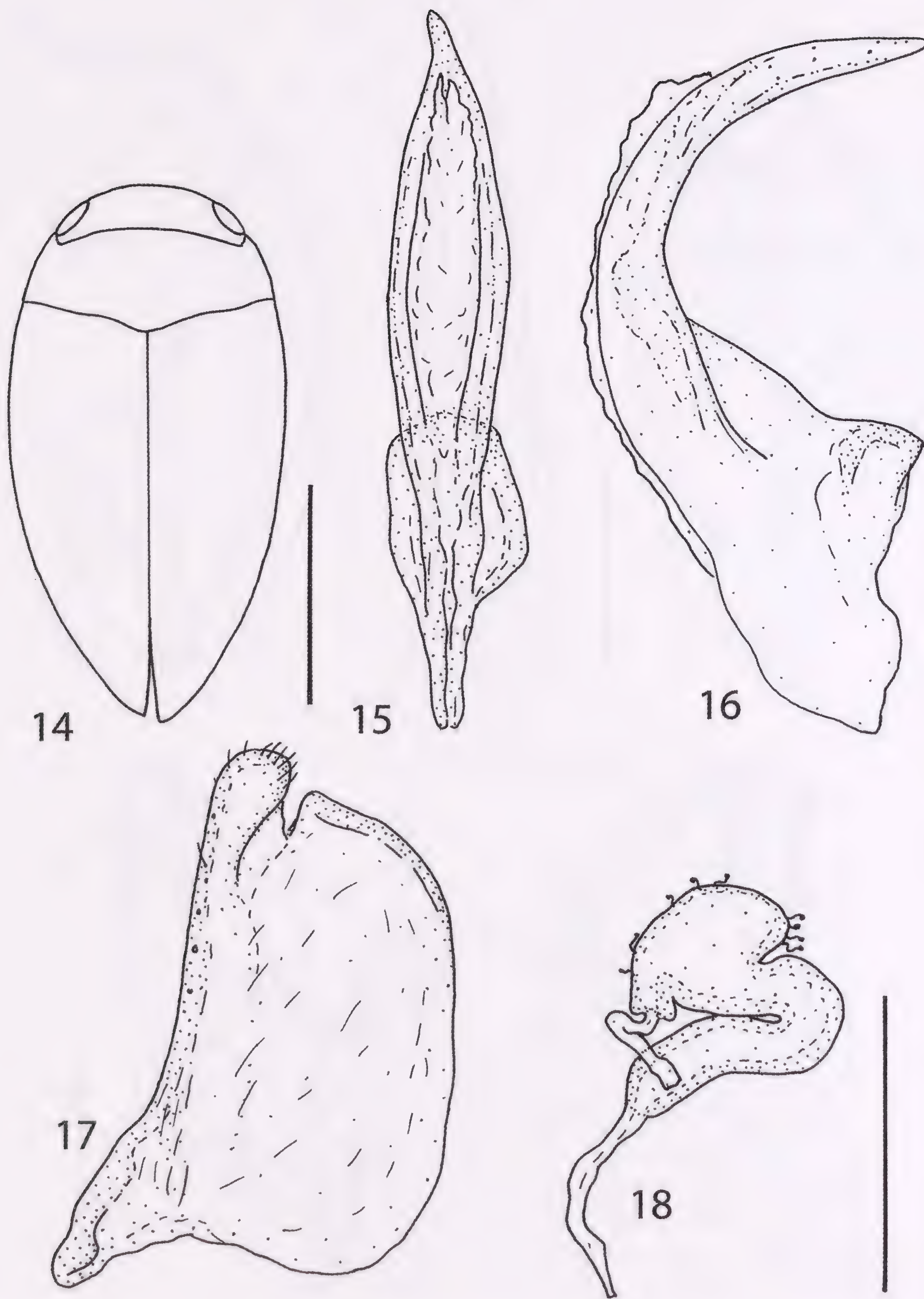
Figs 3-7. *Canthyporus canthydroides*: 3 - habitus, male, lectotype; 4 - penis, ventral aspect; 5 - penis, lateral aspect; 6 - paramere, external aspect; 7 - spermathecal tract, Cape Town. Scale bars: 3 (1 mm), 4-7 (0.2 mm).





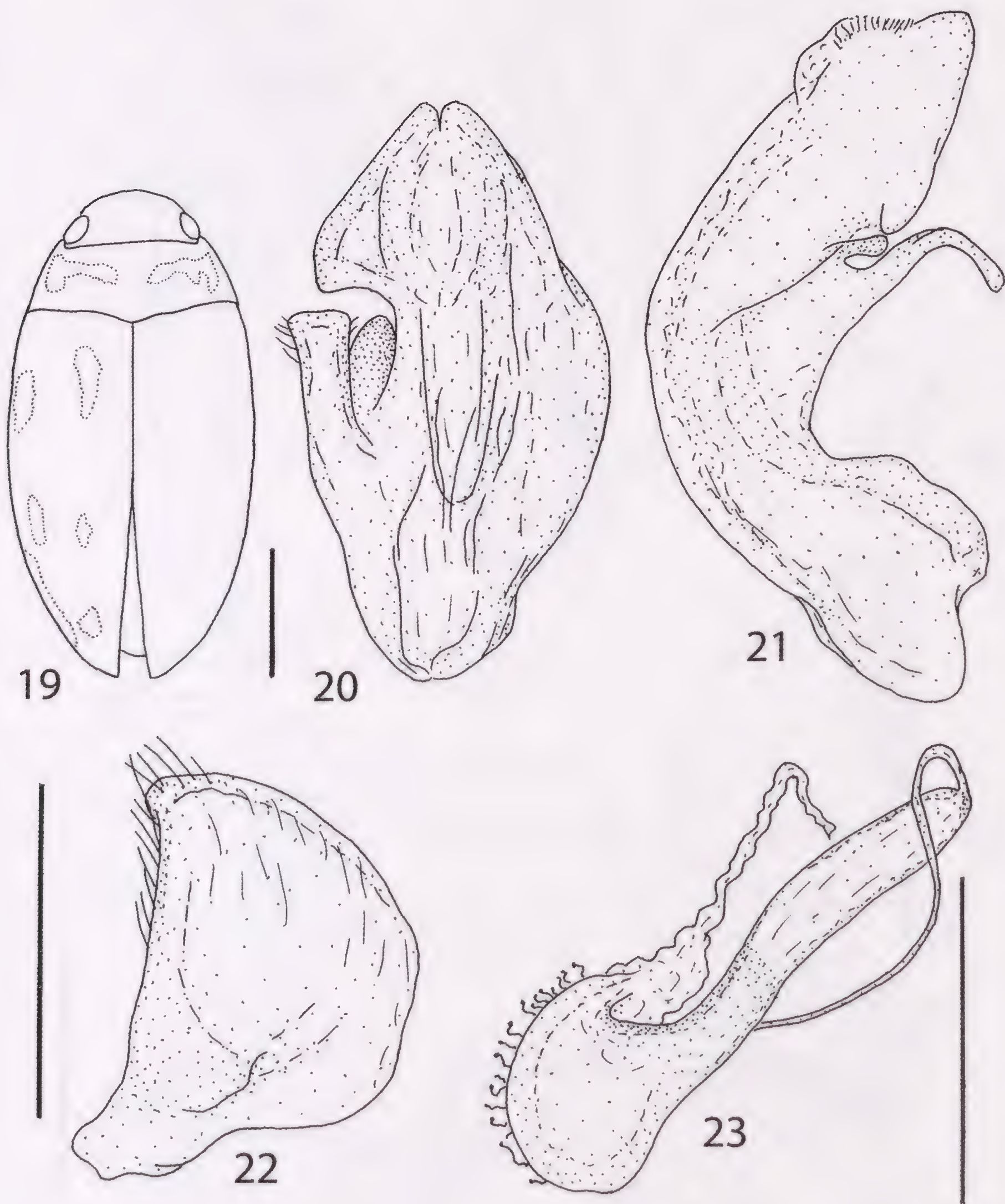
Figs 8-13. *Canthyporus congener*: 8 - habitus, male, Cape Town; 9 - penis, ventral aspect; 10 - penis, lateral aspect; 11 - paramere, external aspect; 12 - spermathecal tract; 13 - spermatheca, alternative direction, RSA, near Wellington. Scale bars: 8 (1 mm), 9-12 (0.2 mm), 13 (no scale bar).





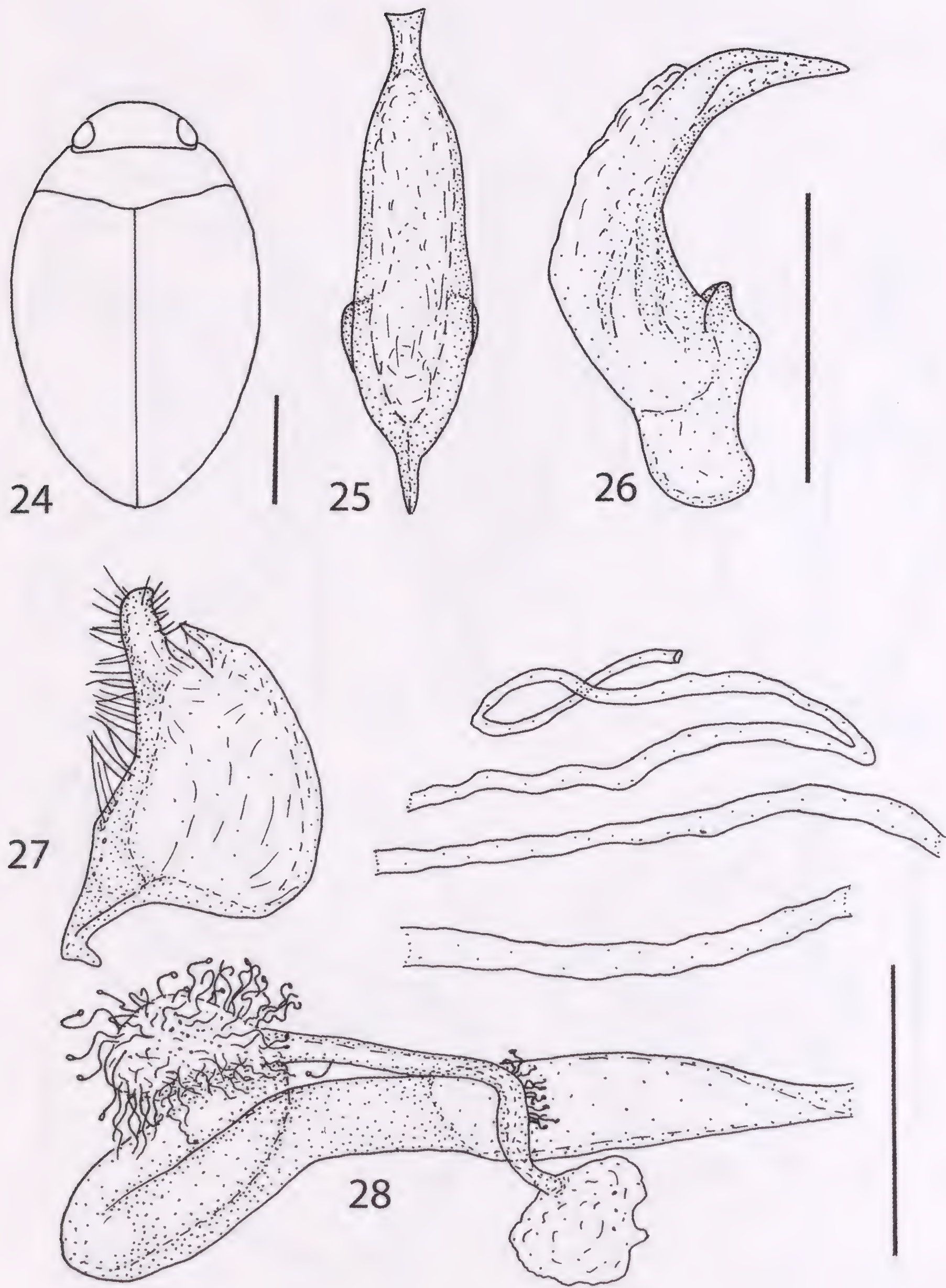
Figs 14-18. *Canthyporus guignoti*: 14 - habitus, male, holotype; 15 - penis, ventral aspect; 16 - penis, lateral aspect; 17 - paramere, external aspect; 18 - spermathecal tract, Humansdorp, Witte-els-Bosch. Scale bars: 14 (1 mm), 15-18 (0.2 mm).





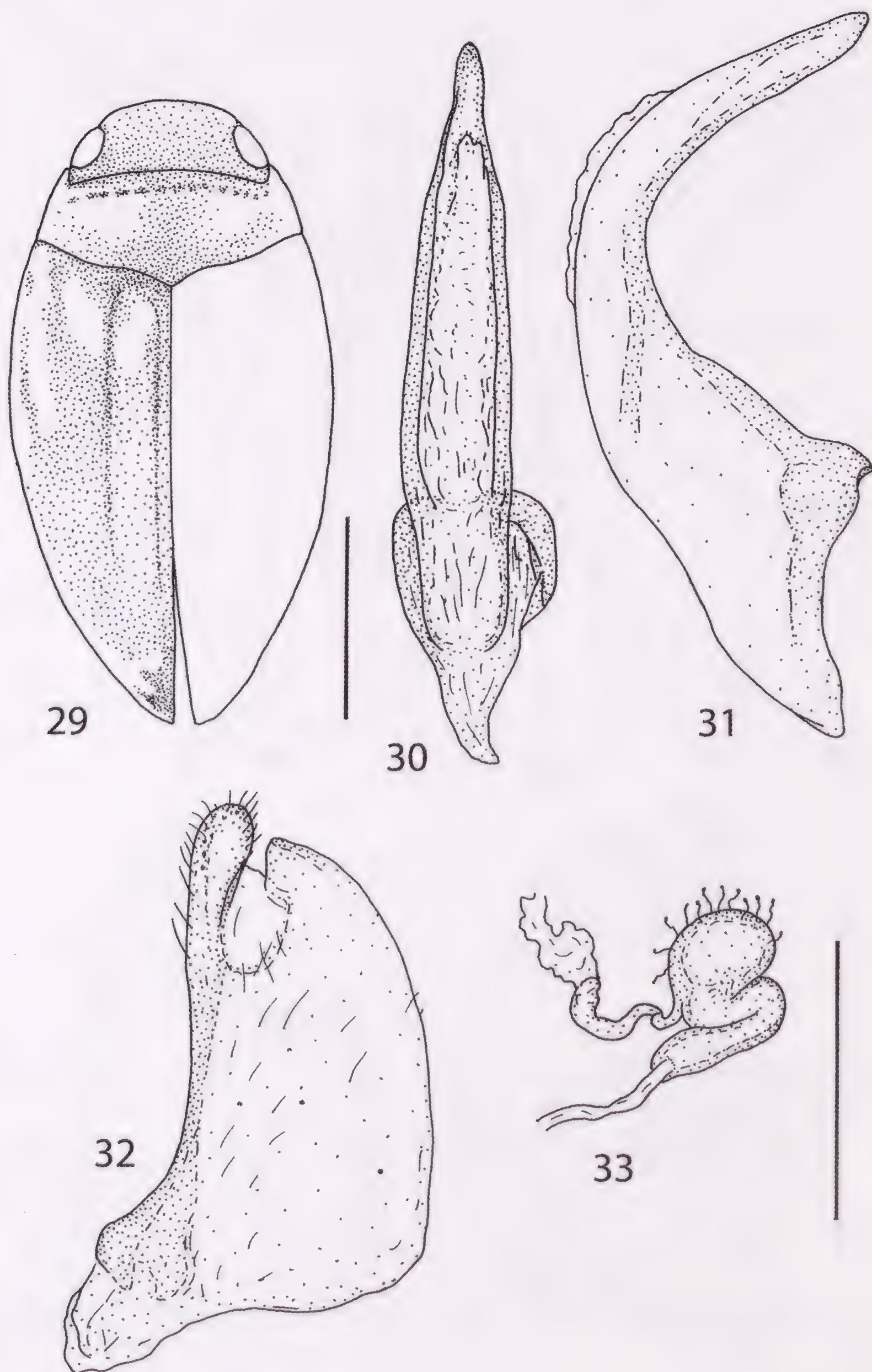
Figs 19-23. *Canthyporus guttatus*: 19 - habitus, male, Naukluft; 20 - penis, ventral aspect; 21 - penis, lateral aspect; 22 - paramere, external aspect; 23 - spermathecal tract, Naukluft. Scale bars: 19 (1 mm), 20-22 (0.4 mm), 23 (0.2 mm).





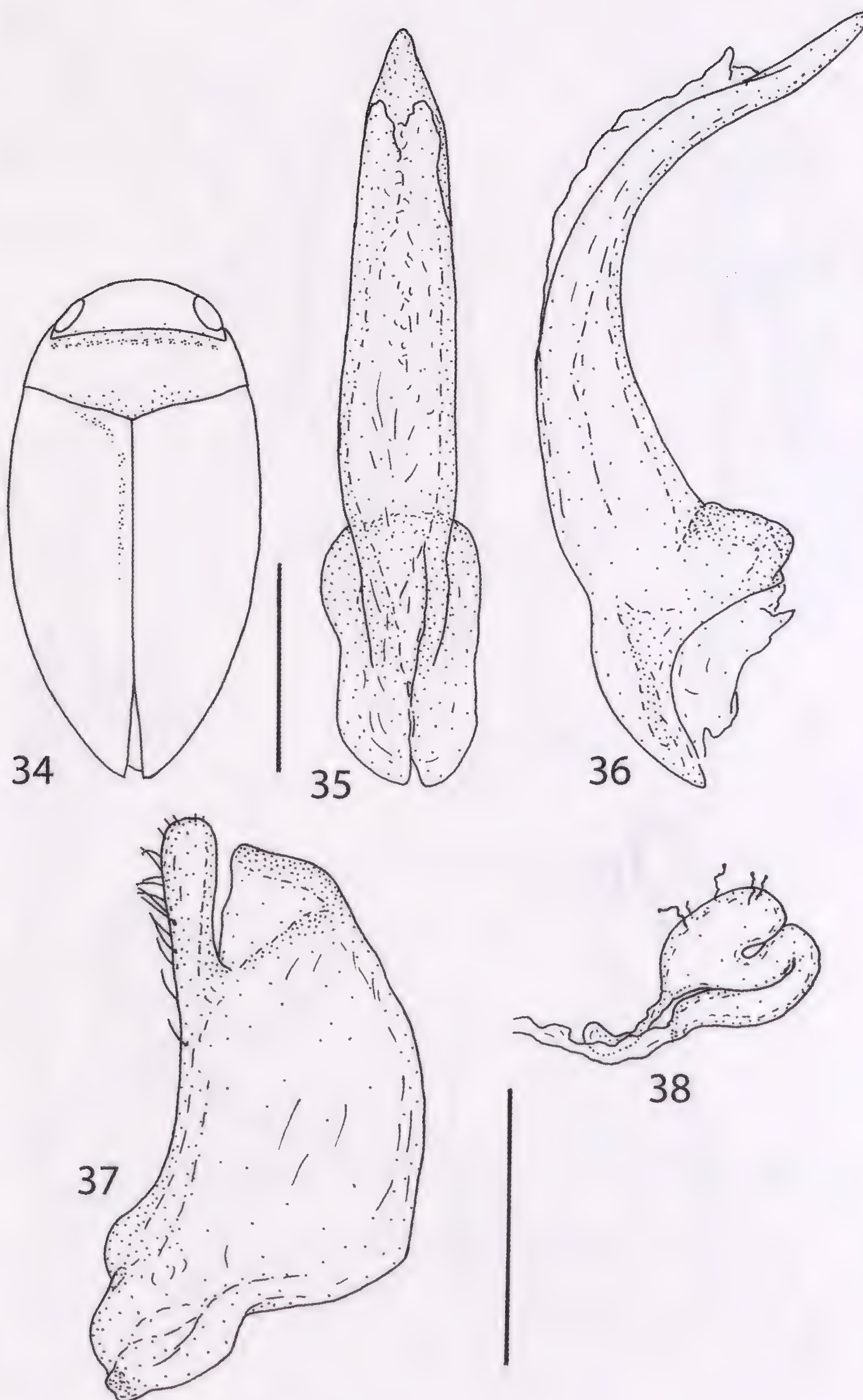
Figs 24-28. *Canthyporus latus*: 24 - habitus, male, lectotype; 25 - penis, ventral aspect; 26 - penis, lateral aspect; 27 - paramere, external aspect; 28 - spermathecal tract and parts of ductus, Skrufteberg, Alfreds Berg Pass. Scale bars: 24 (1 mm), 25-27 (0.4 mm), 28 (0.2 mm).





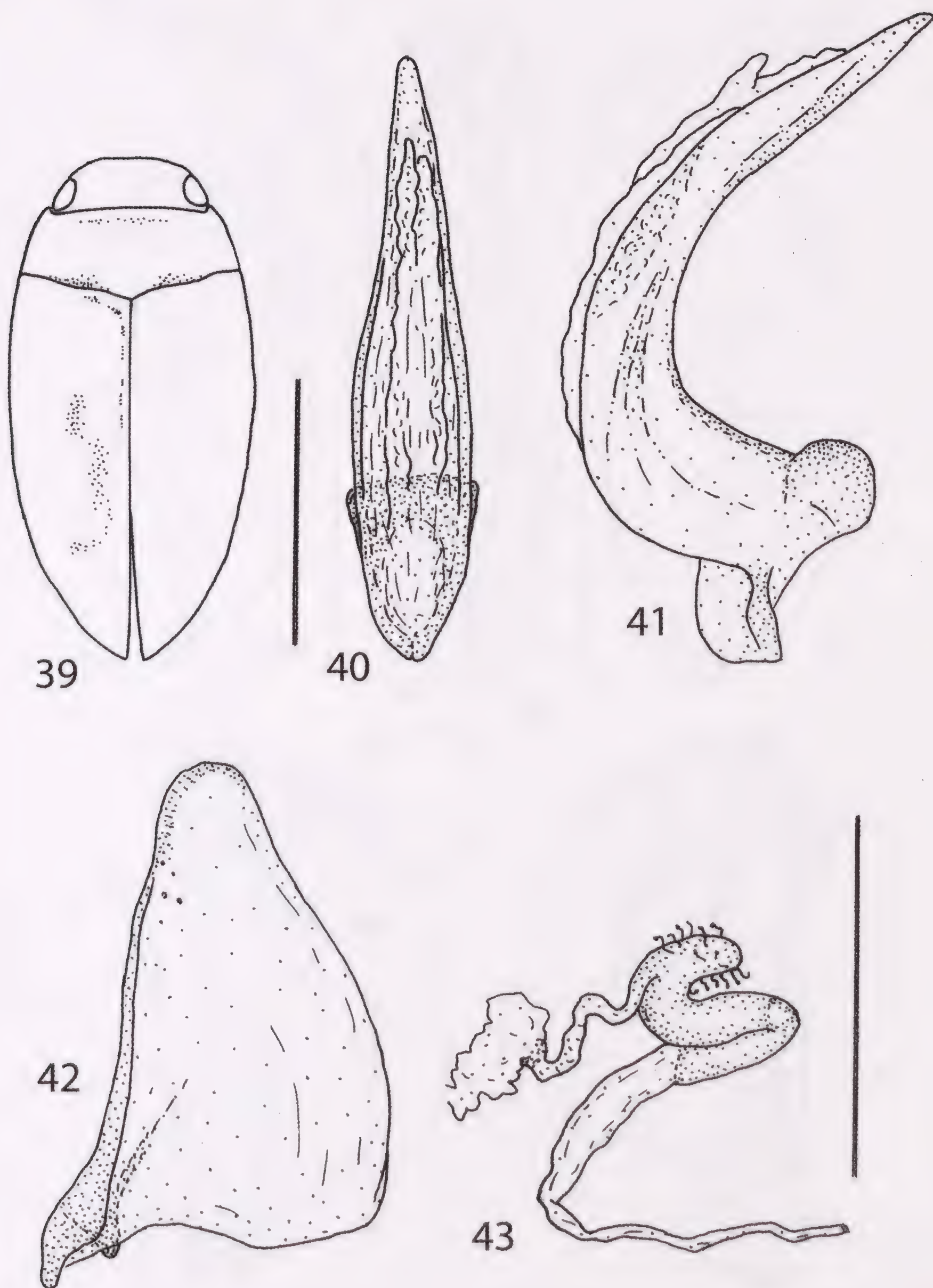
Figs 29-33. *Canthyporus navigator*: 29 - habitus, male, paratype; 30 - penis, ventral aspect; 31 - penis, lateral aspect; 32 - paramere, external aspect; 33 - spermathecal tract, Gordon's Bay. Scale bars: 29 (1 mm), 30-33 (0.2 mm).





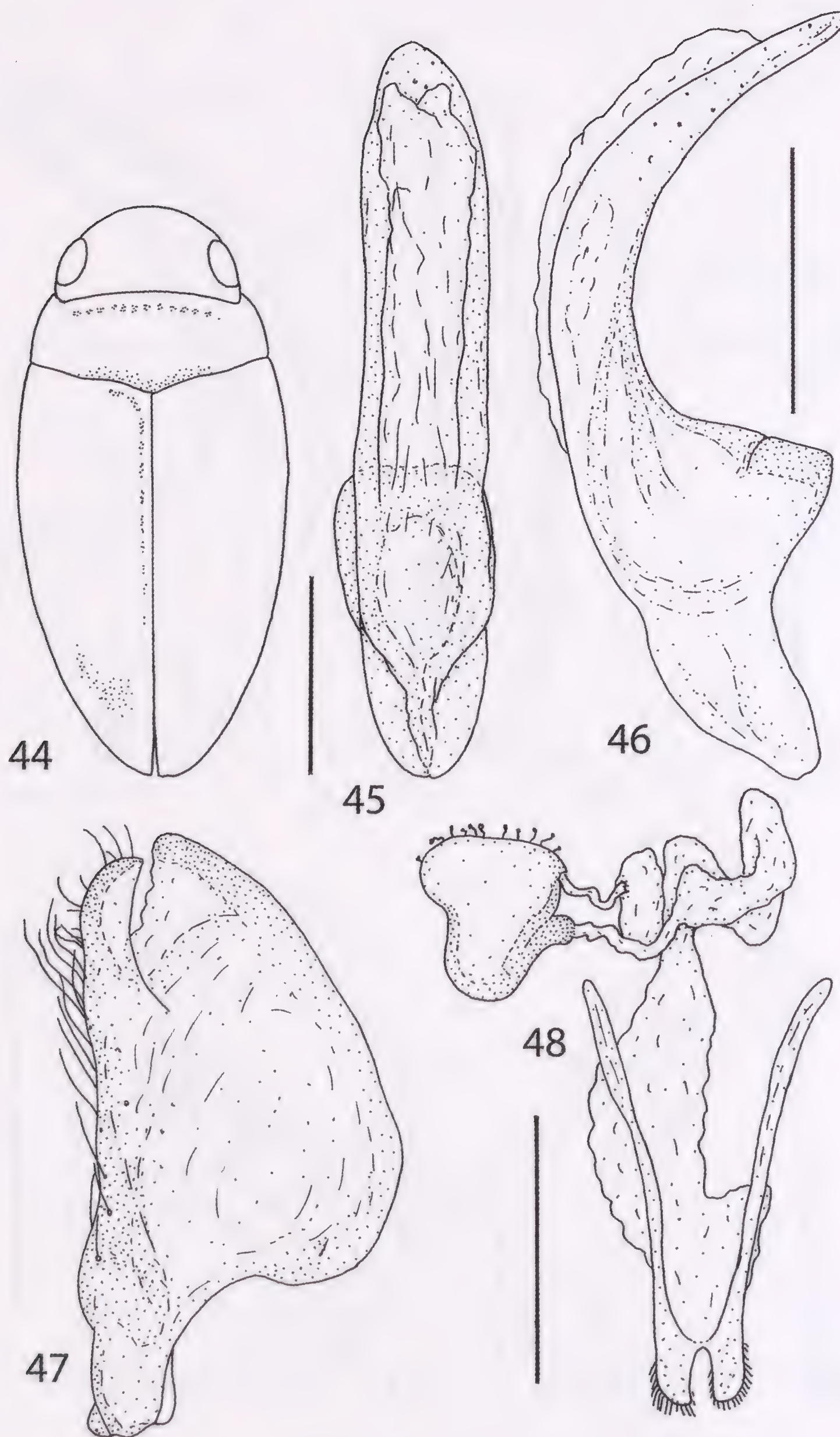
Figs 34-38. *Canthyporus nimius*: 34 - habitus, male, holotype; 35 - penis, ventral aspect; 36 - penis, lateral aspect; 37 - paramere, external aspect; 38 - spermathecal tract, Witte Elbosch. Scale bars: 34 (1 mm), 35-38 (0.2 mm).





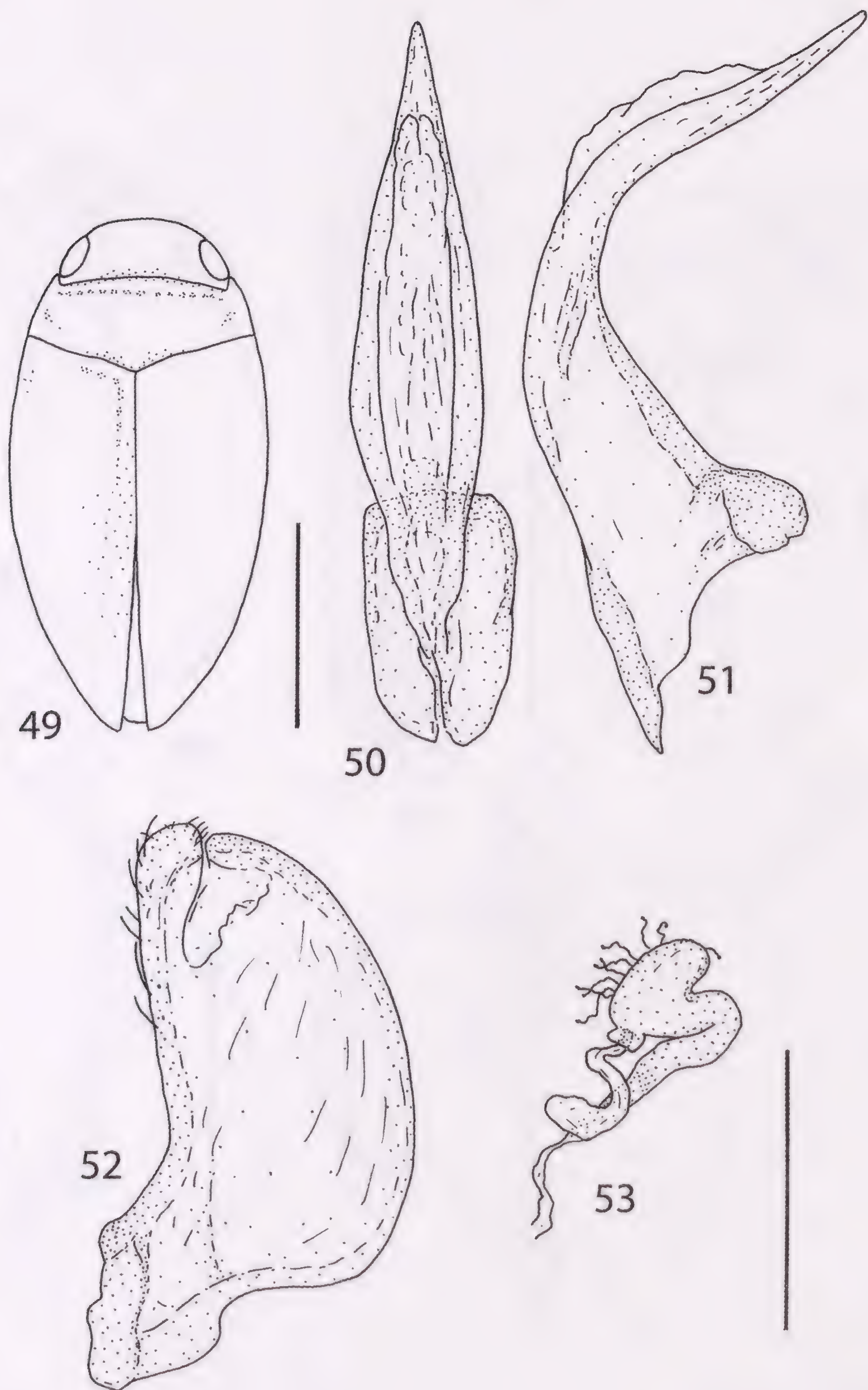
Figs 39-43. *Canthyporus parvus*: 39 - habitus, male, holotype; 40 - penis, ventral aspect; 41 - penis, lateral aspect; 42 - paramere, external aspect; 43 - spermathecal tract, Schusters Kraal. Scale bars: 39 (1 mm), 40-43 (0.2 mm).





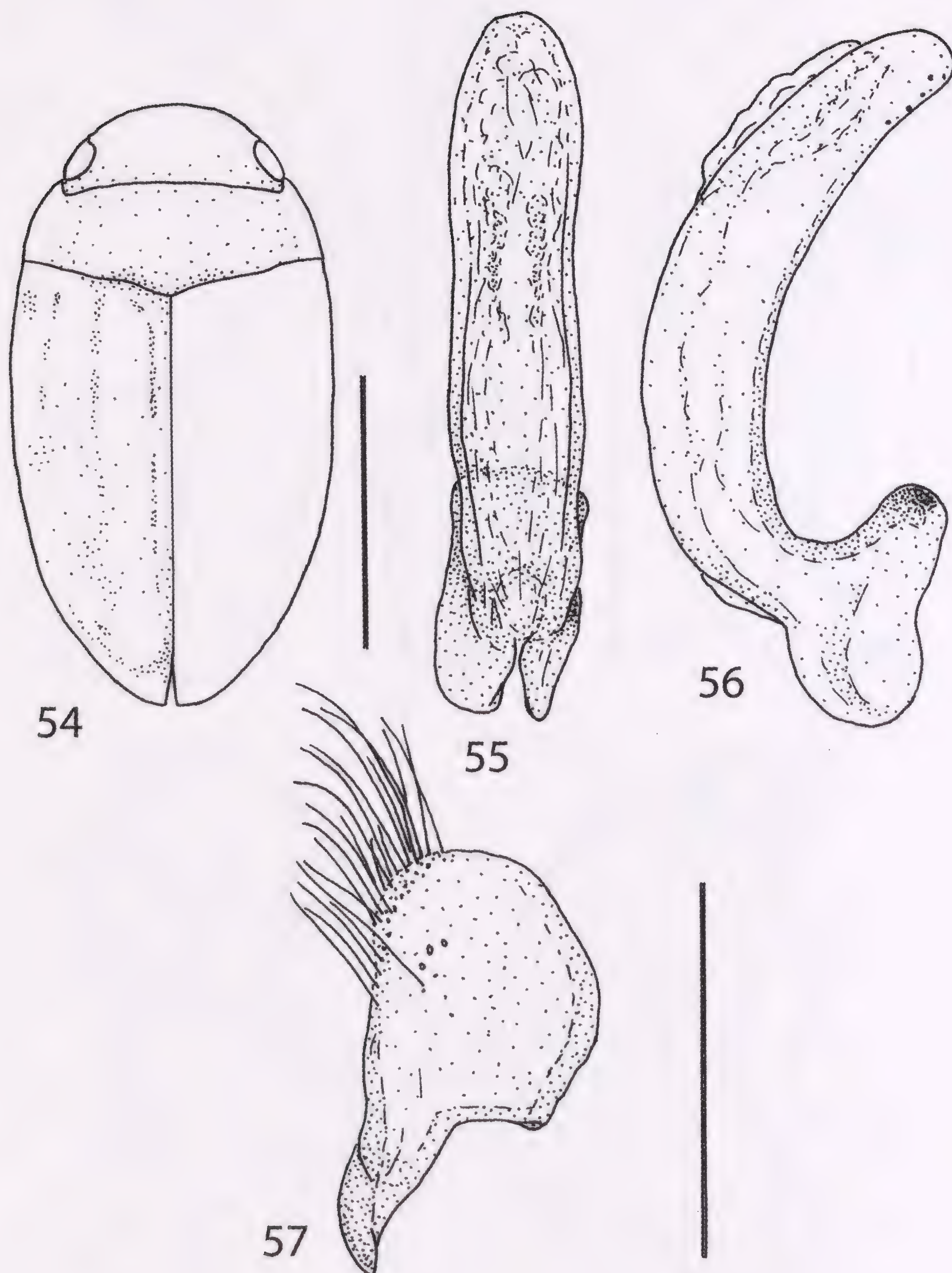
Figs 44-48. *Canthyporus testaceus*: 44 - habitus, male, lectotype; 45 - penis, ventral aspect; 46 - penis, lateral aspect; 47 - paramere, external aspect; 48 - spermathecal tract, bursa copulatrix, and gonocoxae, Cape Point. Scale bars: 44 (1 mm), 45-47 (0.2 mm), 48 (0.4 mm).





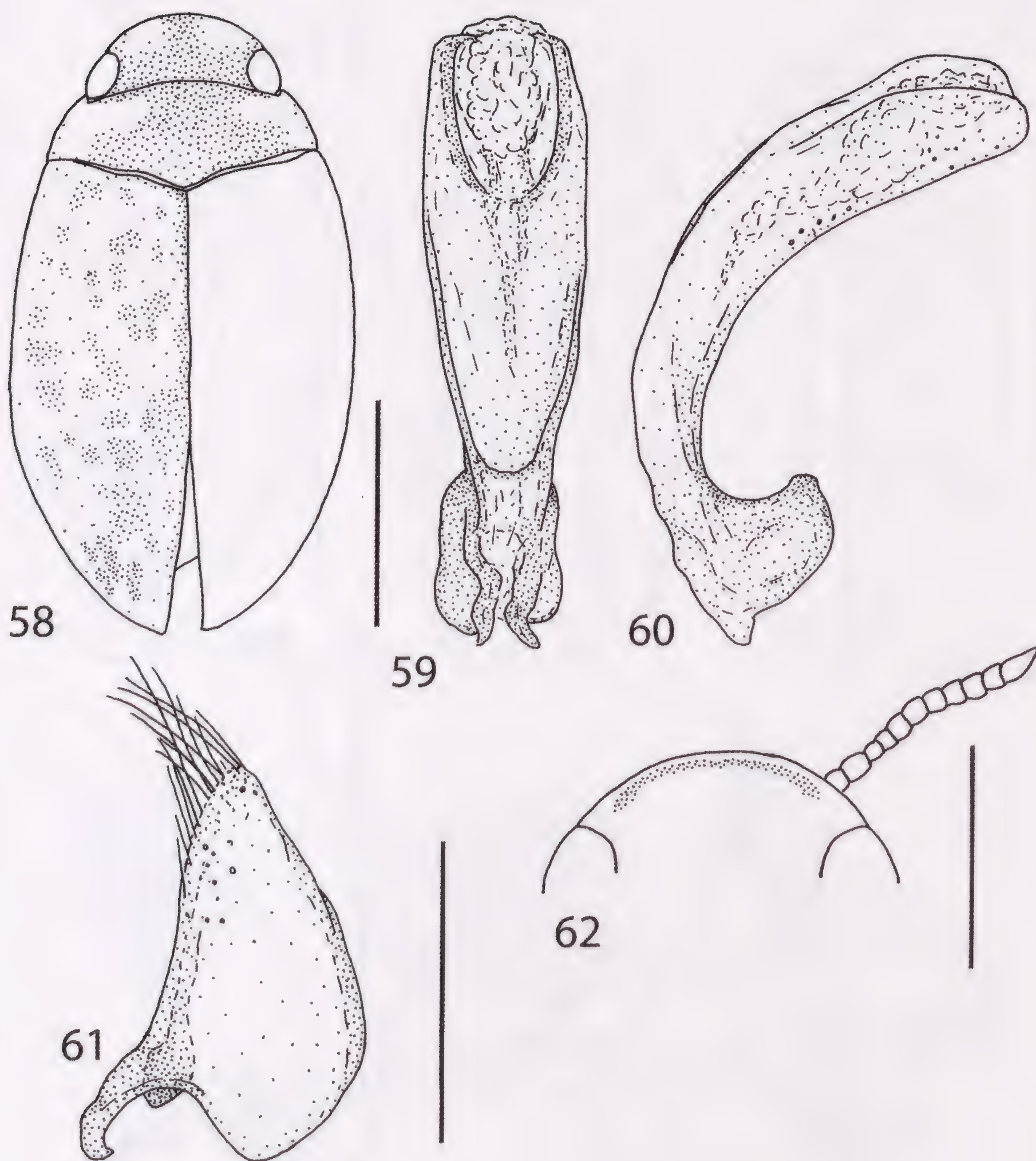
Figs 49-53. *Canthyporus wewalkai*: 49 - habitus, male, holotype; 50 - penis, ventral aspect; 51 - penis, lateral aspect; 52 - paramere, external aspect; 53 - spermathecal tract, Kalabaskraal. Scale bars: 49 (1 mm), 50-53 (0.2 mm).





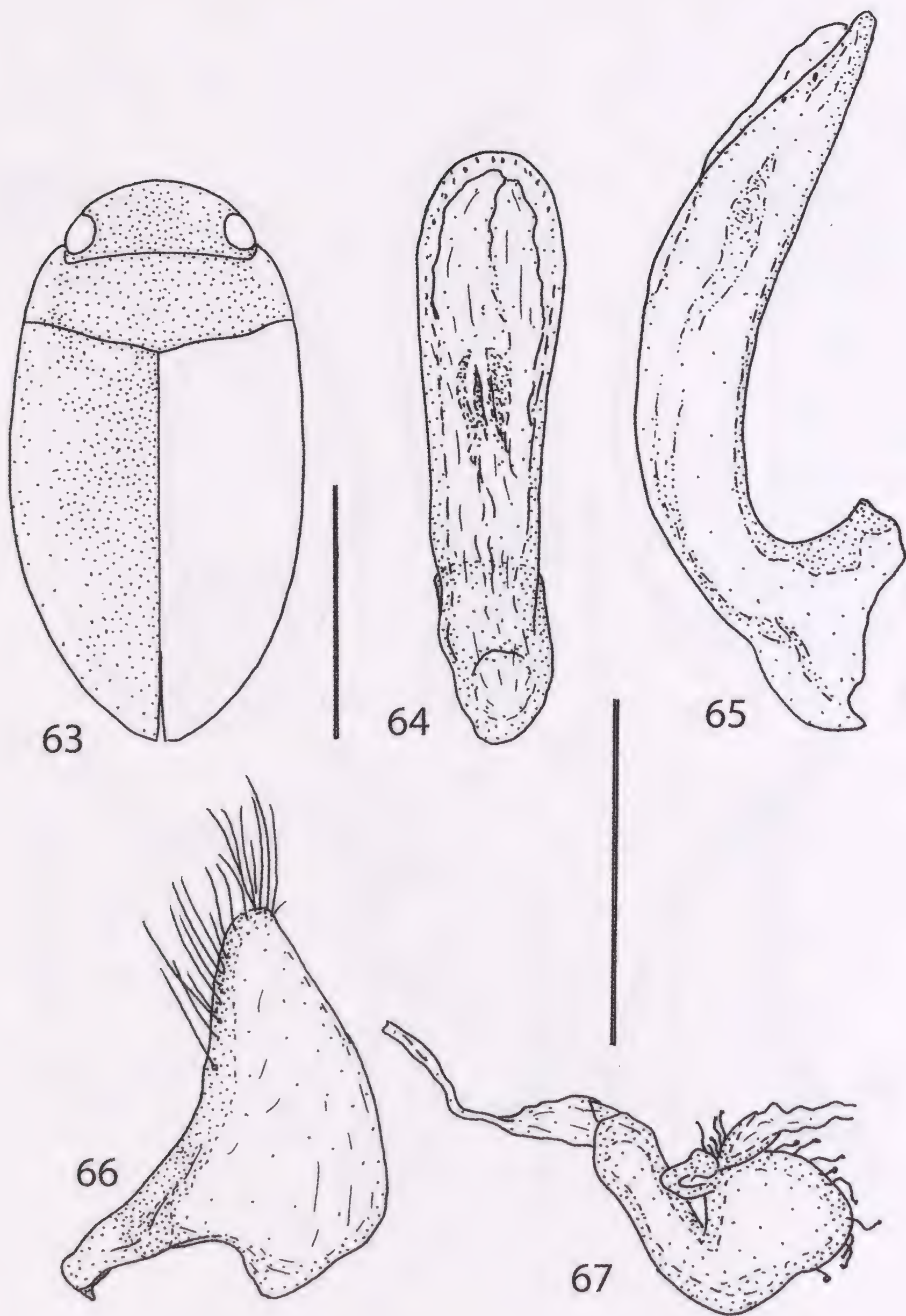
Figs 54-57. *Canthyporus brincki*: 54 - habitus, male, holotype; 55 - penis, ventral aspect; 56 - penis, lateral aspect; 57 - paramere, external aspect. Scale bars: 54 (1 mm), 55-57 (0.2 mm).





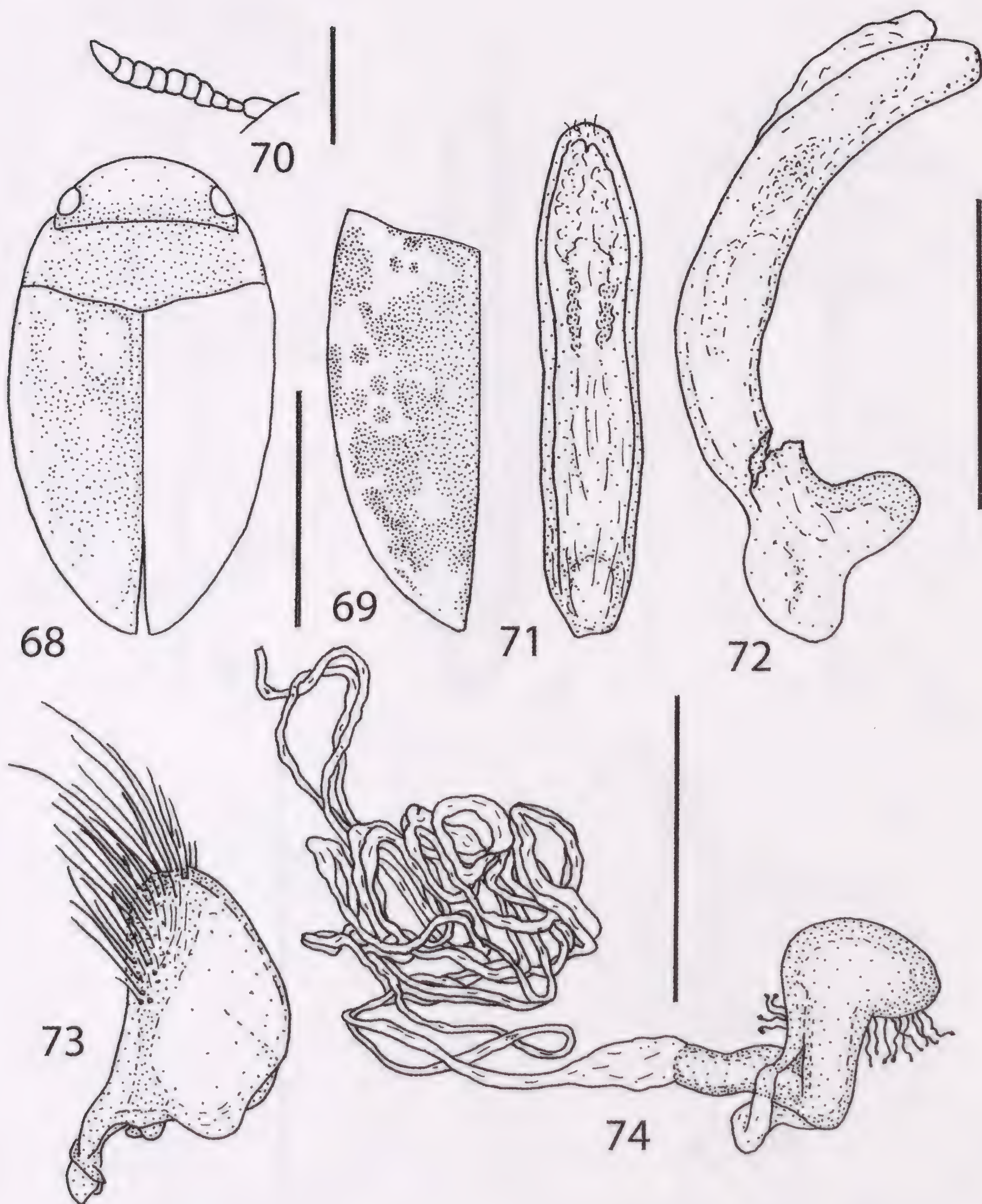
Figs 58-62. *Canthyporus aenigmaticus*: 58 - habitus, male, holotype; 59 - penis, ventral aspect; 60 - penis, lateral aspect; 61 - paramere, external aspect; 62 - head and right antenna. Scale bars: 58 (1 mm), 59-61 (0.2 mm), 62 (0.5 mm).





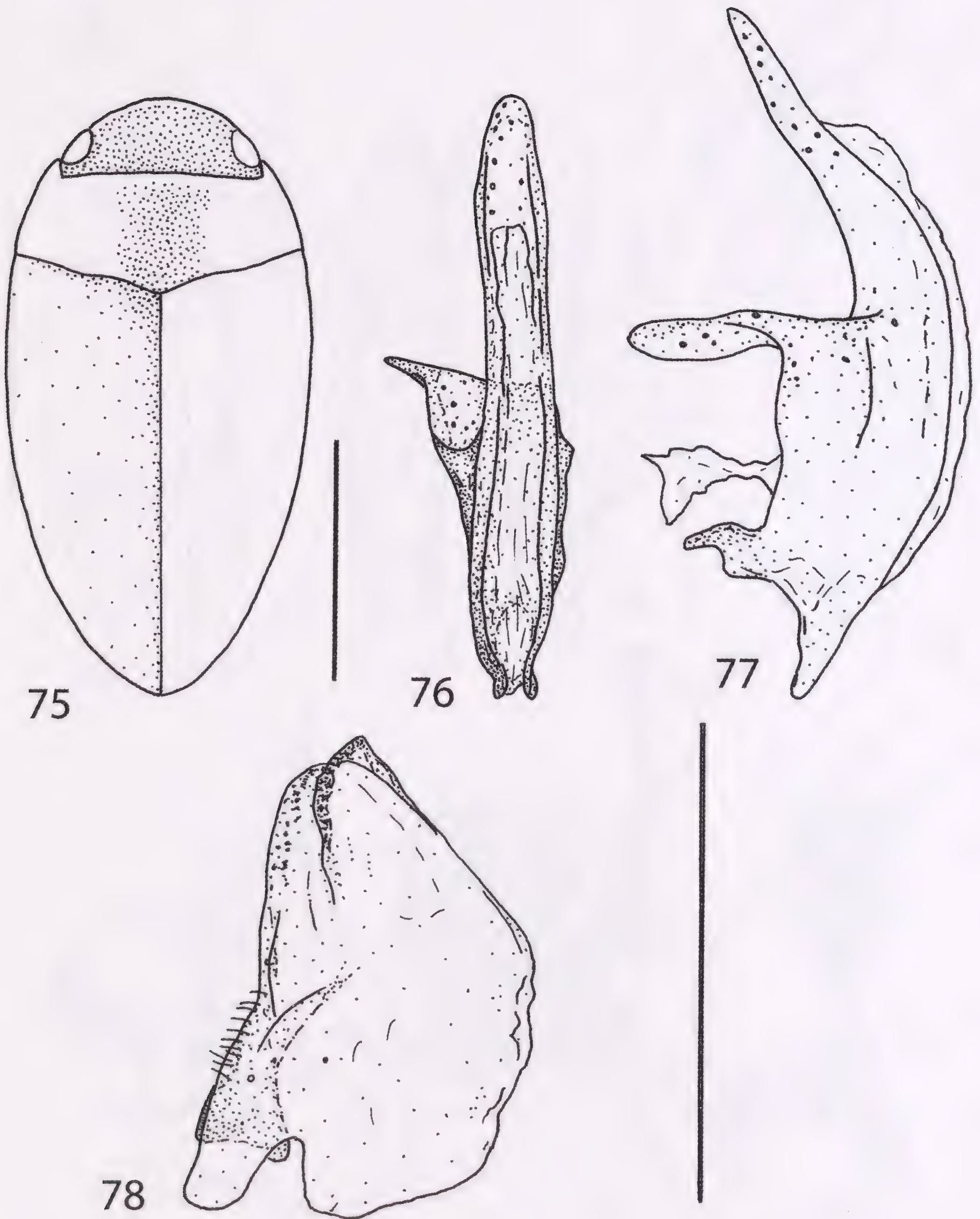
Figs 63-67. *Canthyporus exilis*: 63 - habitus, male, Cape of Good Hope; 64 - penis, ventral aspect; 65 - penis, lateral aspect; 66 - paramere, external aspect; 67 - spermathecal tract, Hex River Mts. Scale bars: 63 (1 mm), 64-67 (0.2 mm).





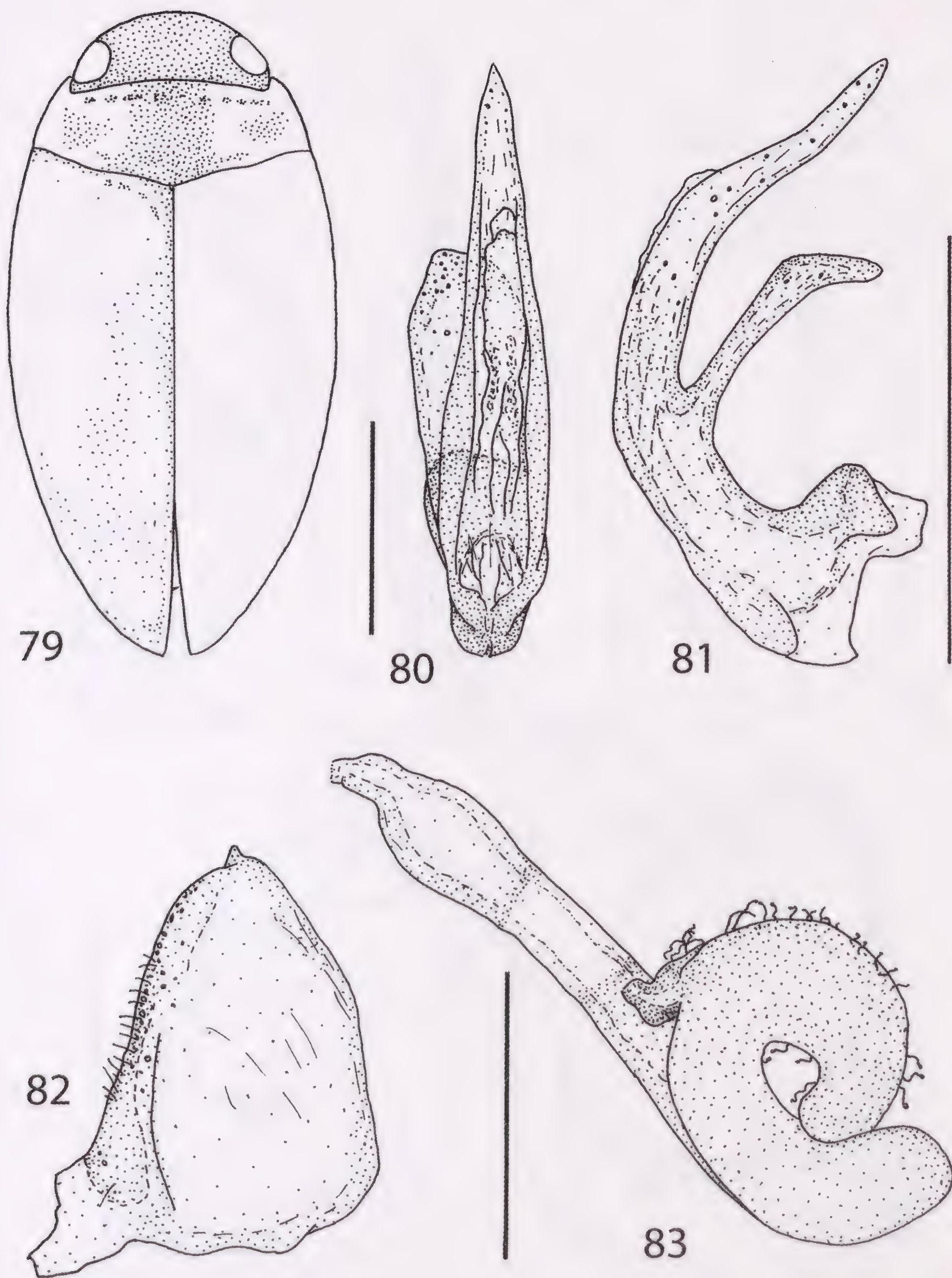
Figs 68-74. *Canthyporus nebulosus*: 68 - habitus, male, lectotype; 69 - left elytron, male, Cape Town; 70 - left antenna; 71 - penis, ventral aspect; 72 - penis, lateral aspect; 73 - paramere, external aspect; 74 - spermathecal tract, Cape Prov. Scale bars: 68-69 (1 mm), 70 (0.25 mm), 71-74 (0.2 mm).





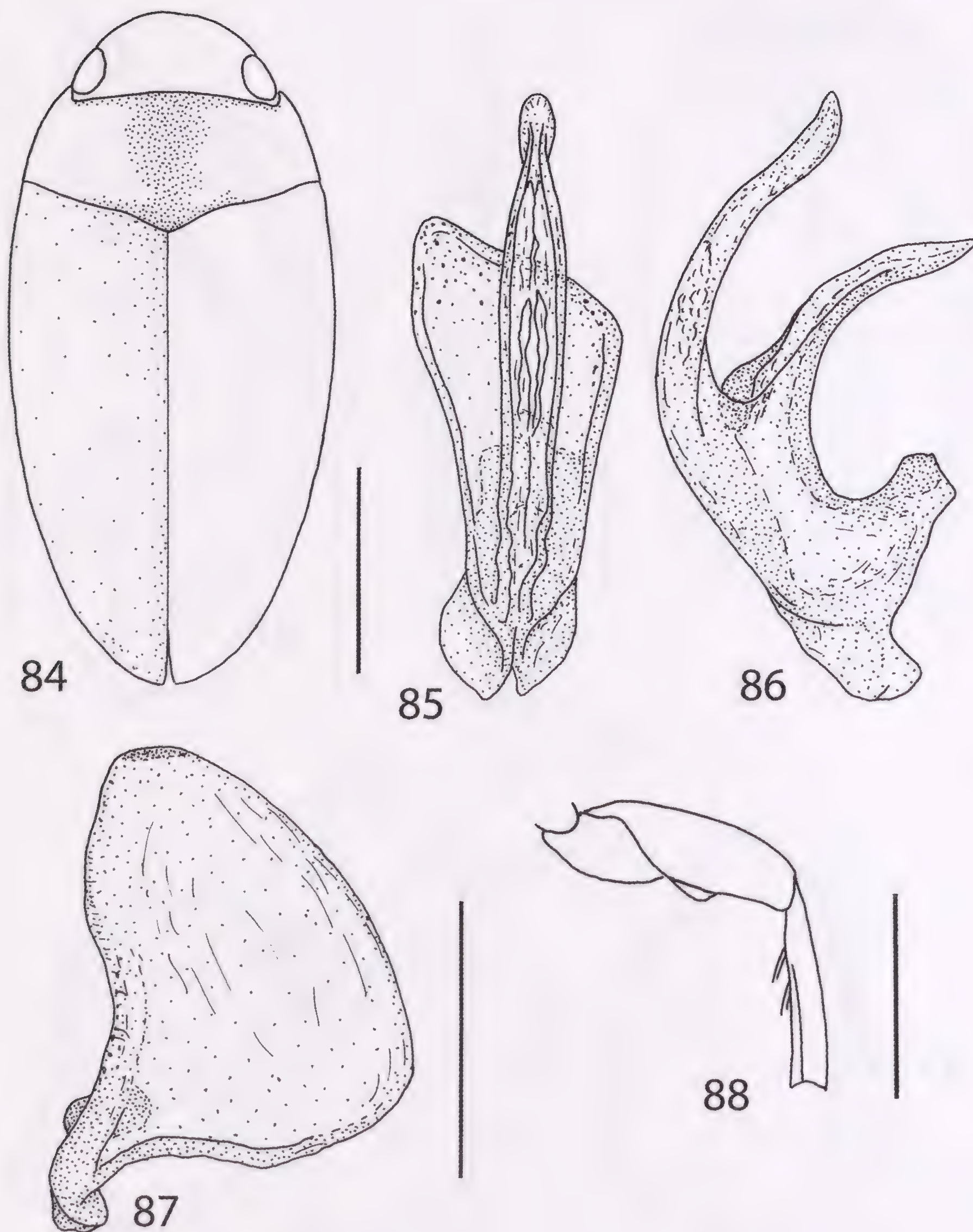
Figs 75-78. *Canthyporus alpestris*: 75 - habitus, male, holotype; 76 - penis, ventral aspect; 77 - penis, lateral aspect; 78 - paramere, external aspect. Scale bars: 75 (1 mm), 76-78 (0.4 mm).





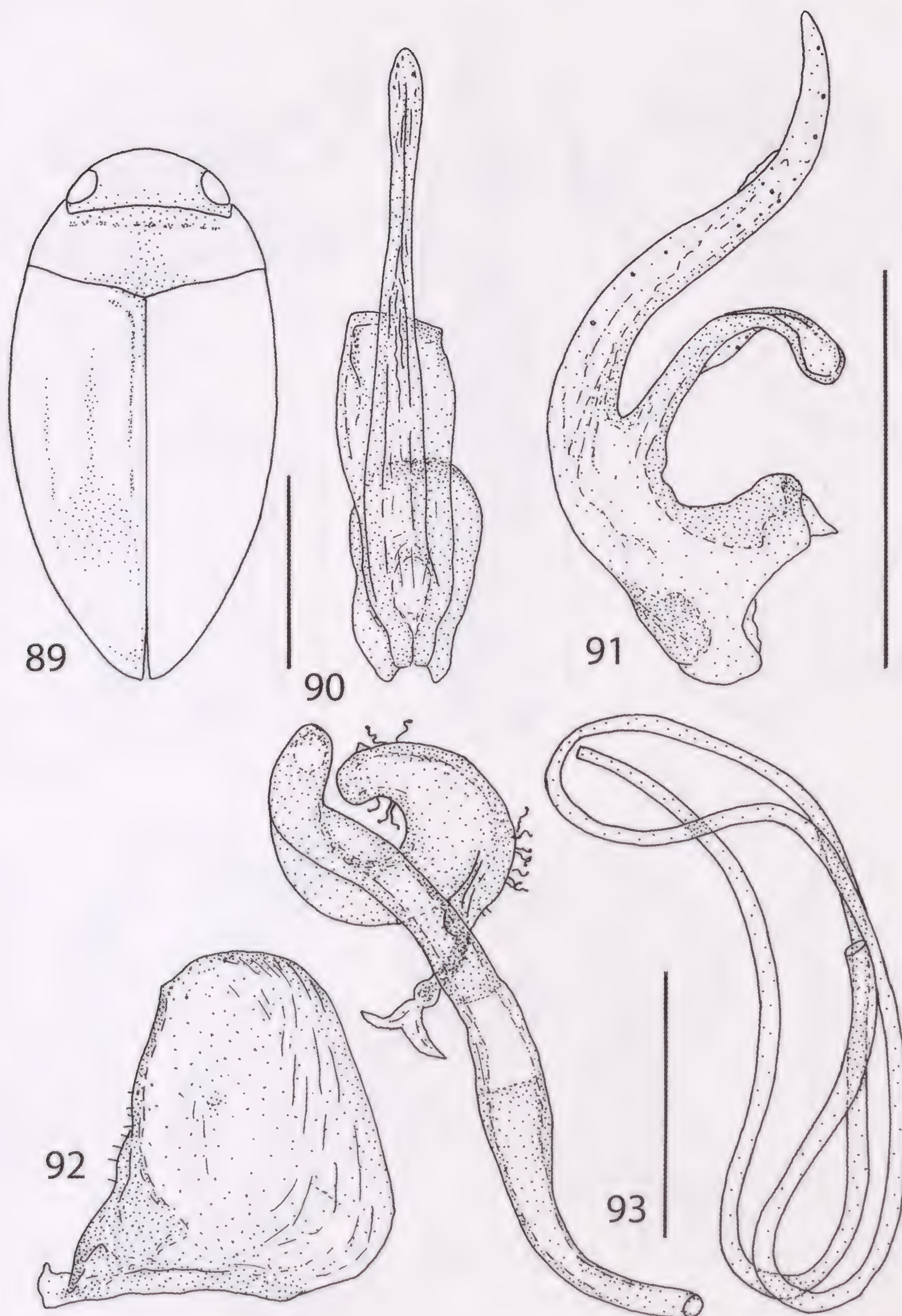
Figs 79-83. *Canthyporus alvei*: 79 - habitus, male, lectotype; 80 - penis, ventral aspect; 81 - penis, lateral aspect; 82 - paramere, external aspect; 83 - spermathecal tract, Karoo N.P. Scale bars: 79 (1 mm), 80-82 (0.4 mm), 83 (0.2 mm).





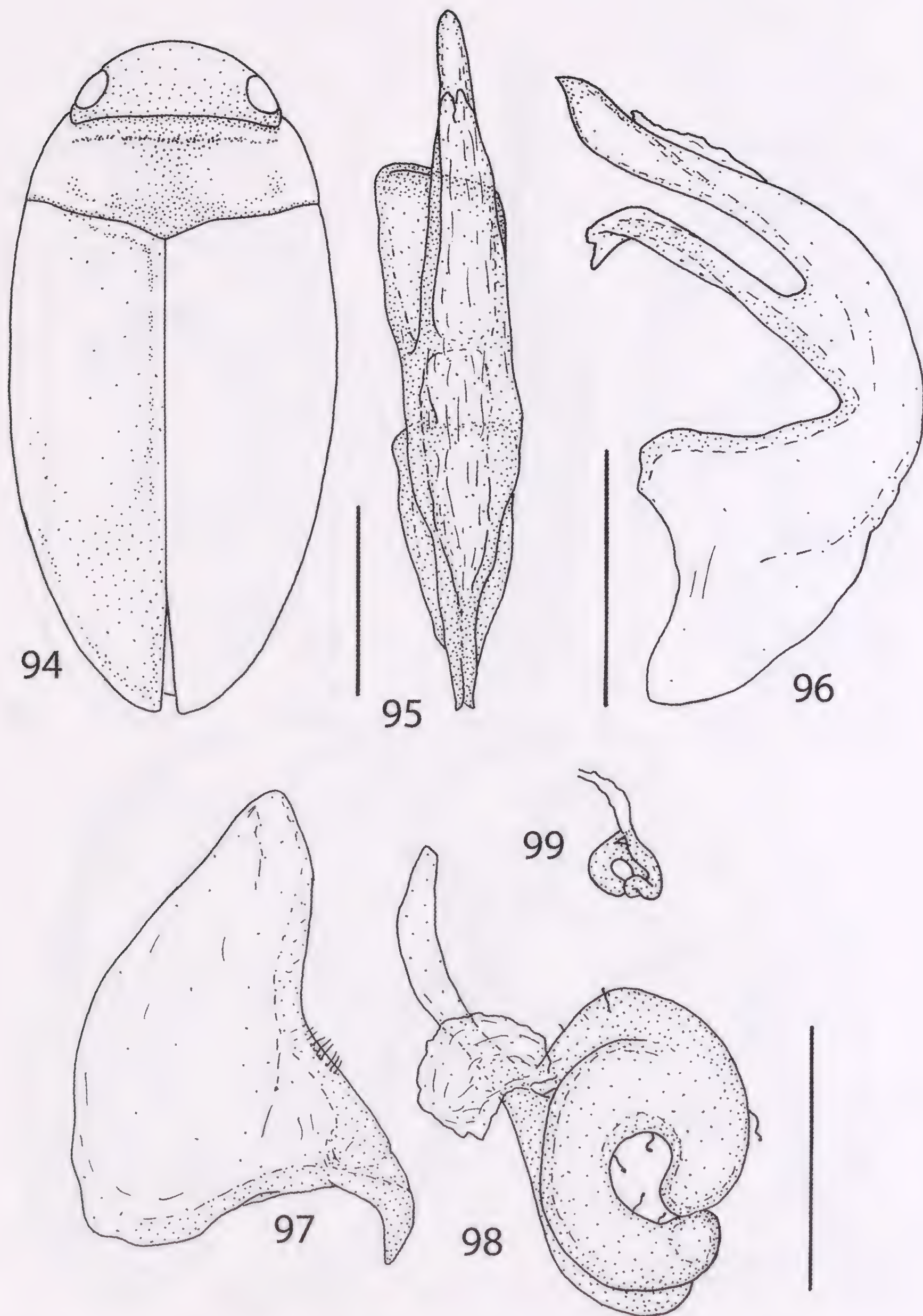
Figs 84-88. *Canthyporus angustatus*: 84 - habitus, male, holotype; 85 - penis, ventral aspect; 86 - penis, lateral aspect; 87 - paramere, external aspect; 88 - metatrochanter, -femur, and -tibia, male. Scale bars: 84 (1 mm), 85-87 (0.2 mm), 88 (0.5 mm).





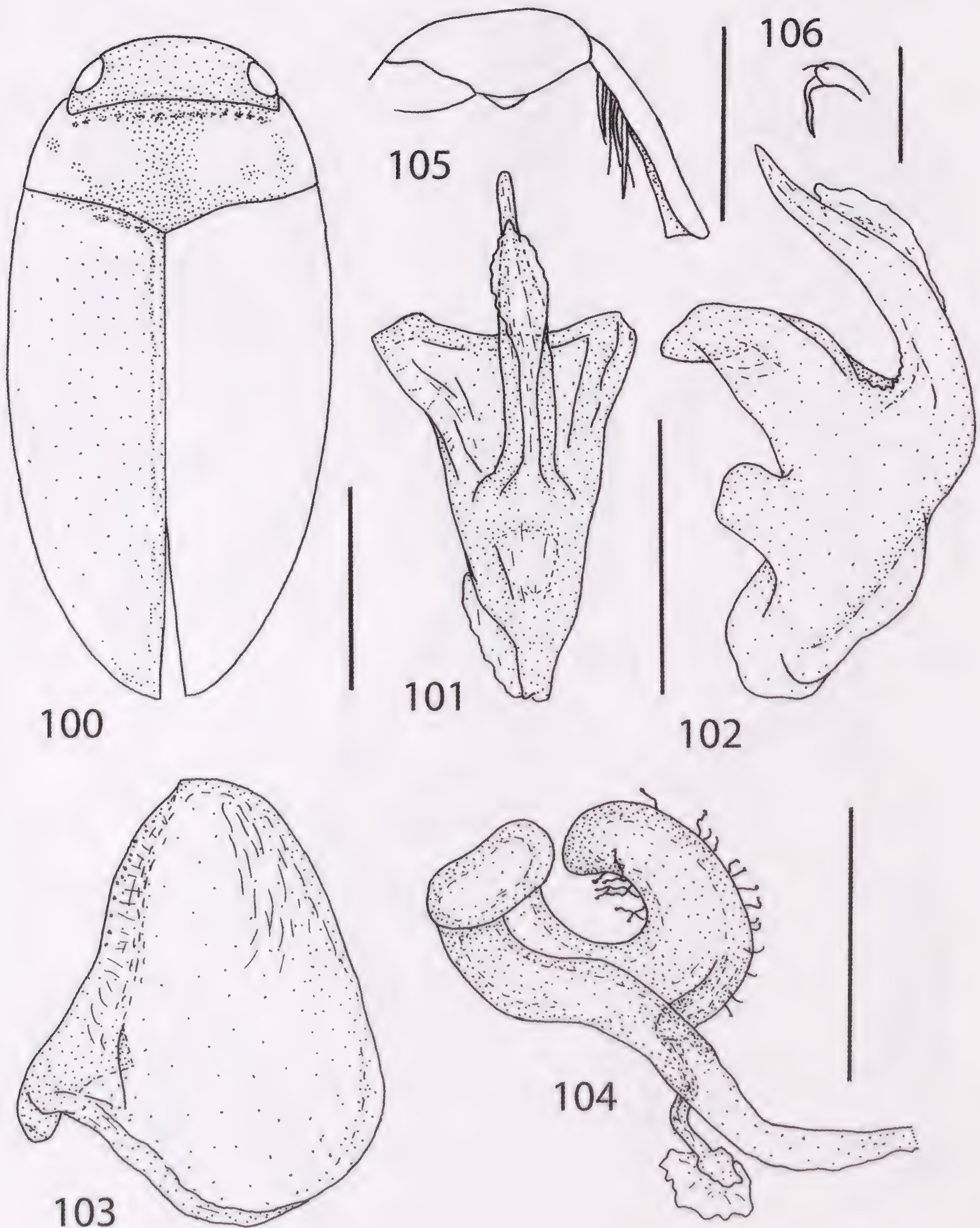
Figs 89-93. *Canthyporus consuetus*: 89 - habitus, male, lectotype; 90 - penis, ventral aspect; 91 - penis, lateral aspect; 92 - paramere, external aspect; 93 - spermathecal tract and parts of ductus, Karoo N.P. Scale bars: 89 (1 mm), 90-92 (0.4 mm), 93 (0.2 mm).





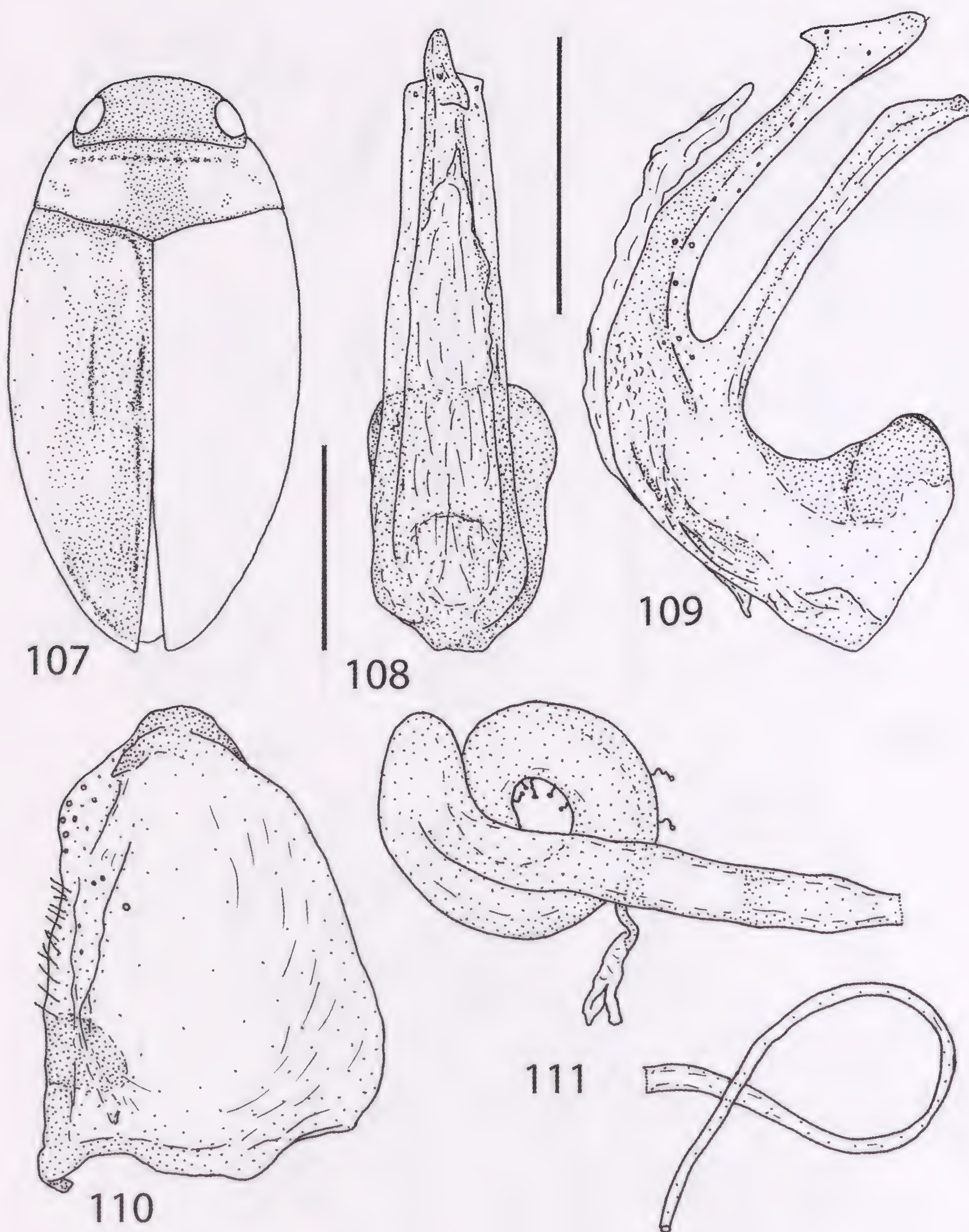
Figs 94-99. *Canthyporus cooperae*: 94 - habitus, female, paratype; 95 - penis, ventral aspect; 96 - penis, lateral aspect, holotype (drawn using a permanent preparation); 97 - paramere, external aspect, ditto; 98 - spermathecal tract; 99 - spermatheca, alternative direction, Hogsback. Scale bars: 94 (1 mm), 95-97 (0.4 mm), 98 (0.2 mm), 99 (no scale bar).





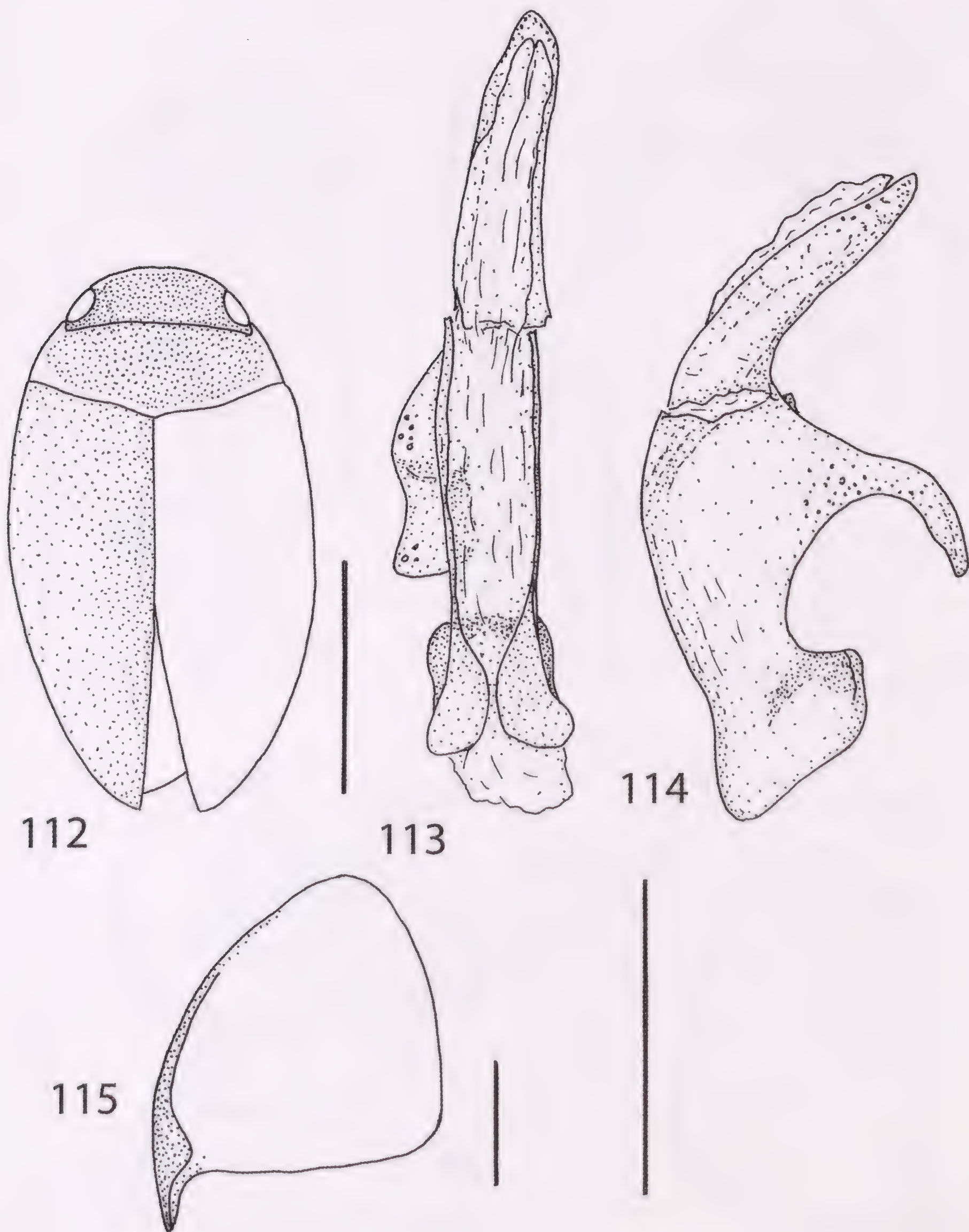
Figs 100-106. *Canthyporus fluviatilis*: 100 - habitus, male, paratype; 101 - penis, ventral aspect; 102 - penis, lateral aspect; 103 - paramere, external aspect; 104 - spermathecal tract, Storms River; 105 - metatrochanter, -femur, and -tibia, male; 106 - protarsal claw, male. Scale bars: 100 (1 mm), 101-103 (0.4 mm), 104 (0.2 mm), 105 (0.5 mm), 106 (0.3 mm).





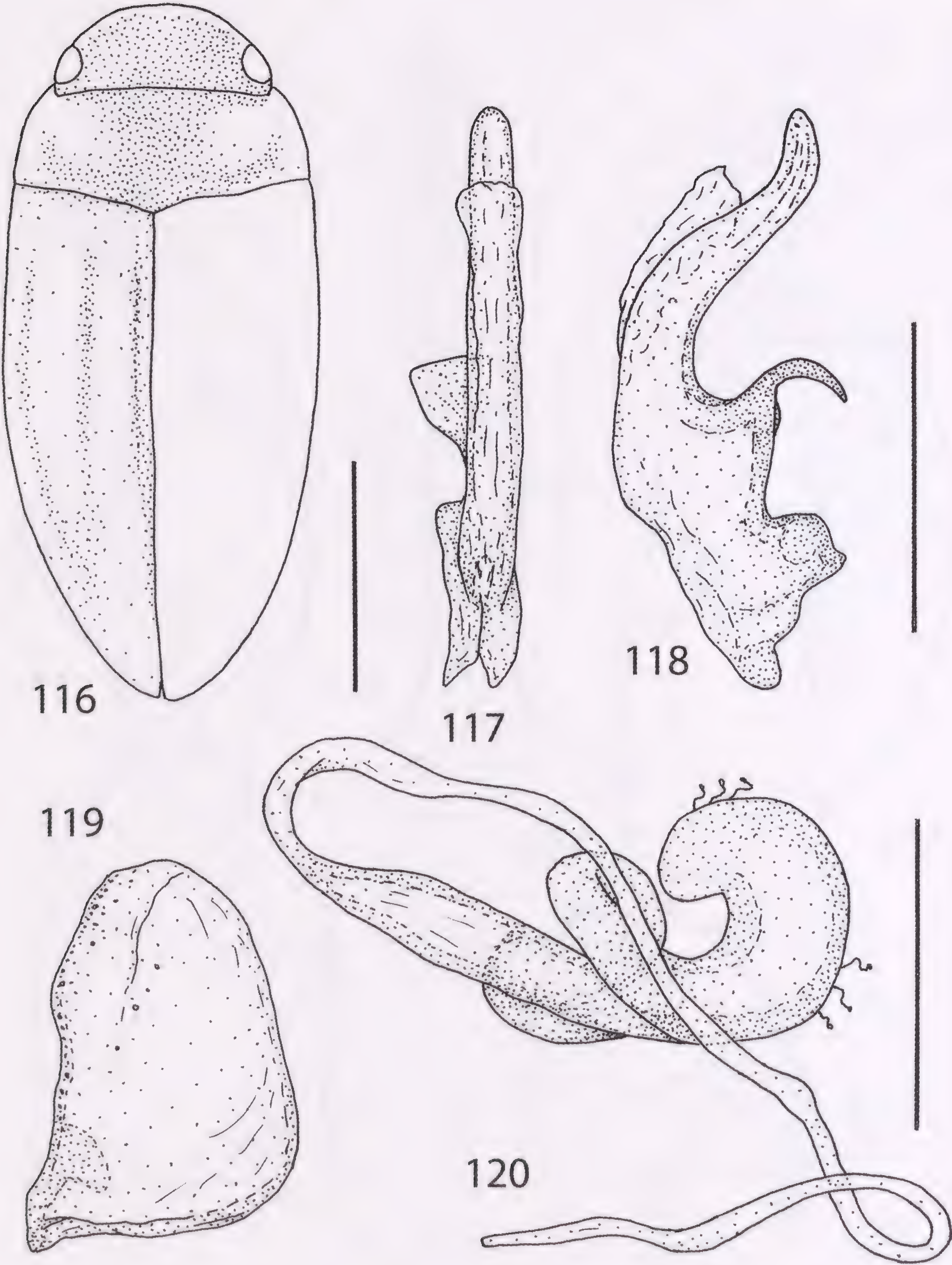
Figs 107-111. *Canthyporus hottentottus*: 107 - habitus, male, Cape Town; 108 - penis, ventral aspect; 109 - penis, lateral aspect; 110 - paramere, external aspect; 111 - spermathecal tract and part of ductus, Cape Town. Scale bars: 107 (1 mm), 108-111 (0.2 mm).





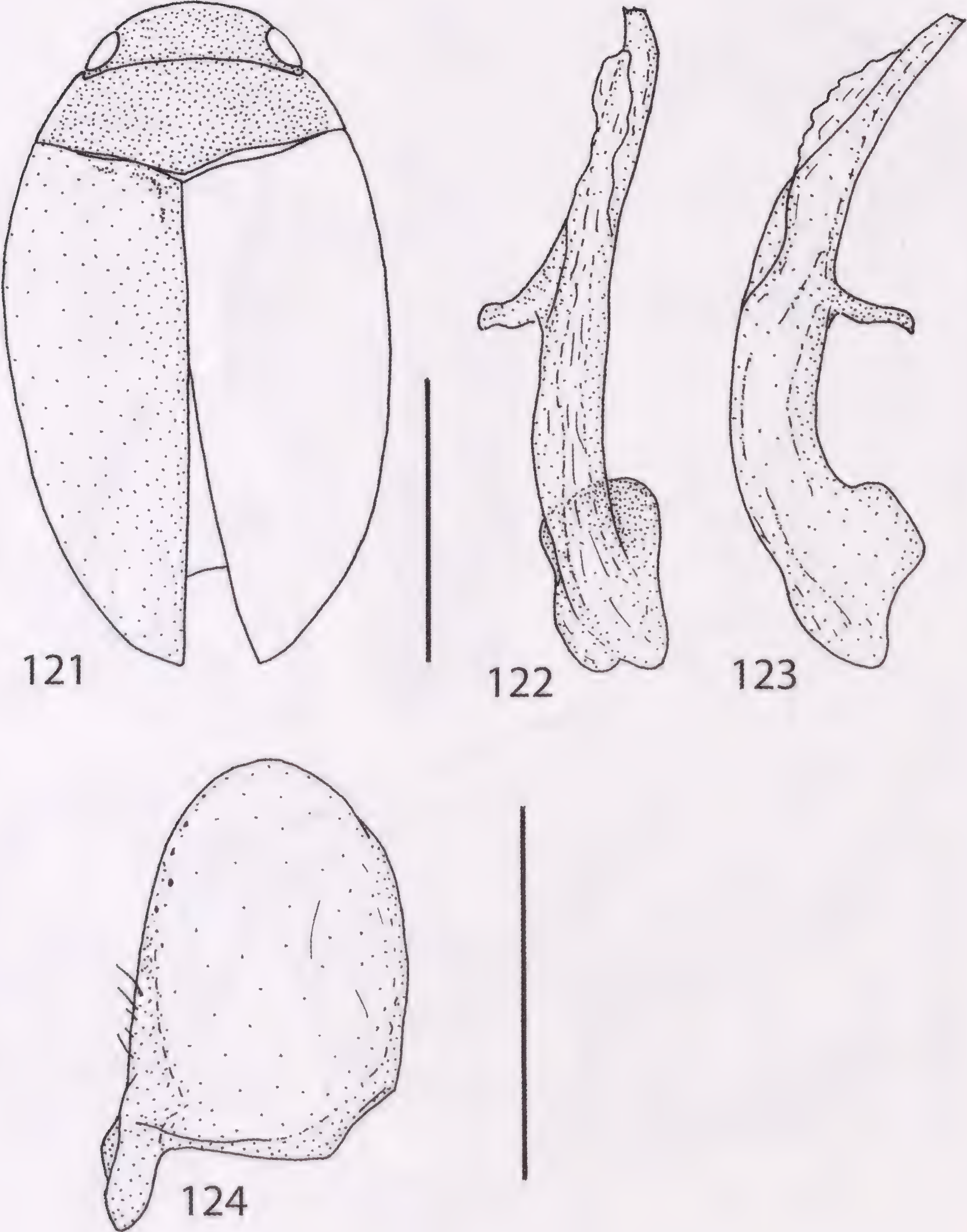
Figs 112-115. *Canthyporus hynesi*: 112 - habitus, female, paratype; 113 - penis, ventral aspect; 114 - penis, lateral aspect; 115 - paramere, internal aspect, redrawn from Nilsson (1991). Scale bars: 112 (1 mm), 113-114 (0.2 mm), 115 (0.1 mm).





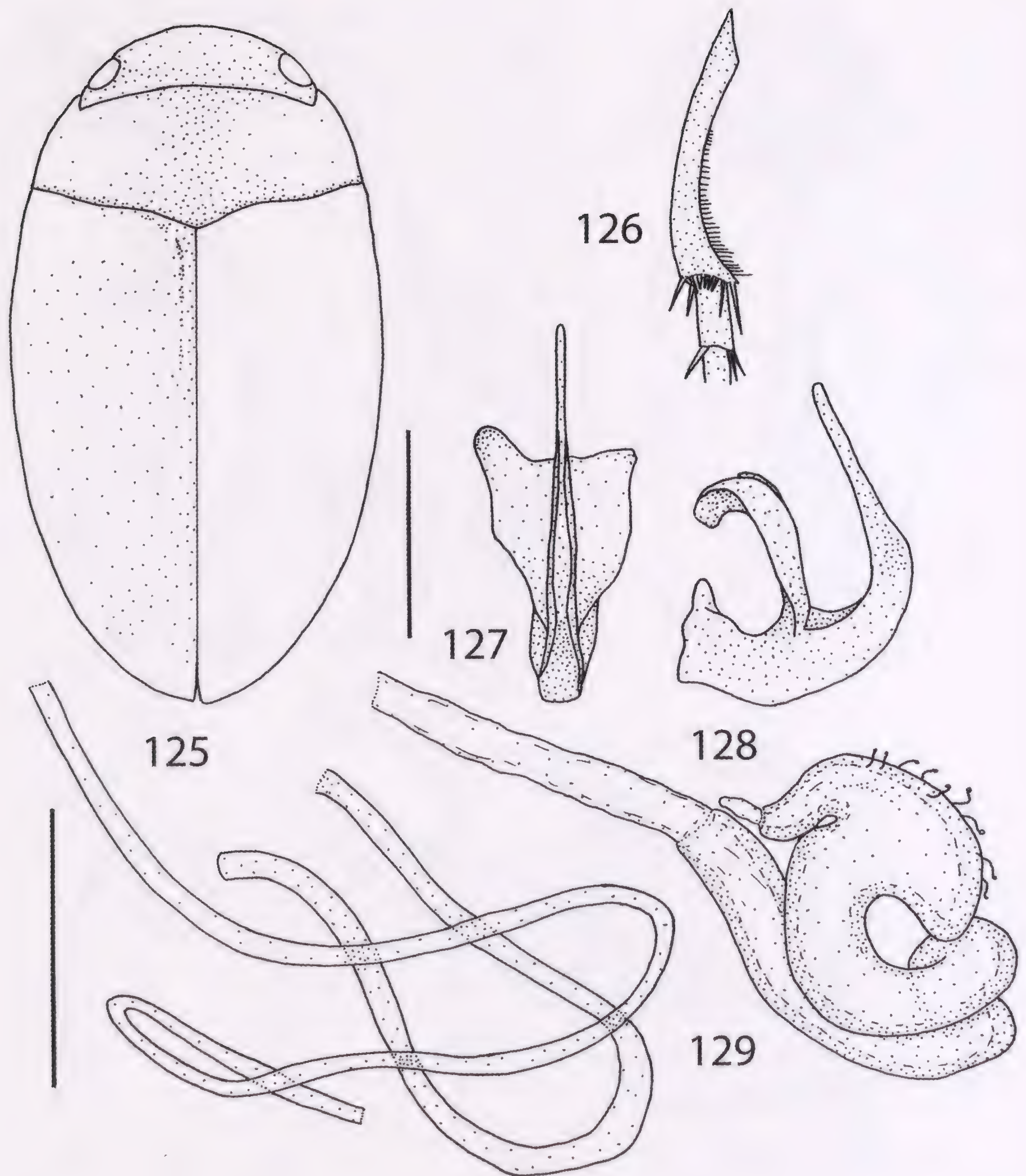
Figs 116-120. *Canthyporus kenyensis*: 116 - habitus, holotype, male; 117 - penis, ventral aspect; 118 - penis, lateral aspect; 119 - paramere, external aspect; 120 - spermathecal tract, Mt. Kenya. Scale bars: 116 (1 mm), 117-119 (0.4 mm), 120 (0.2 mm).





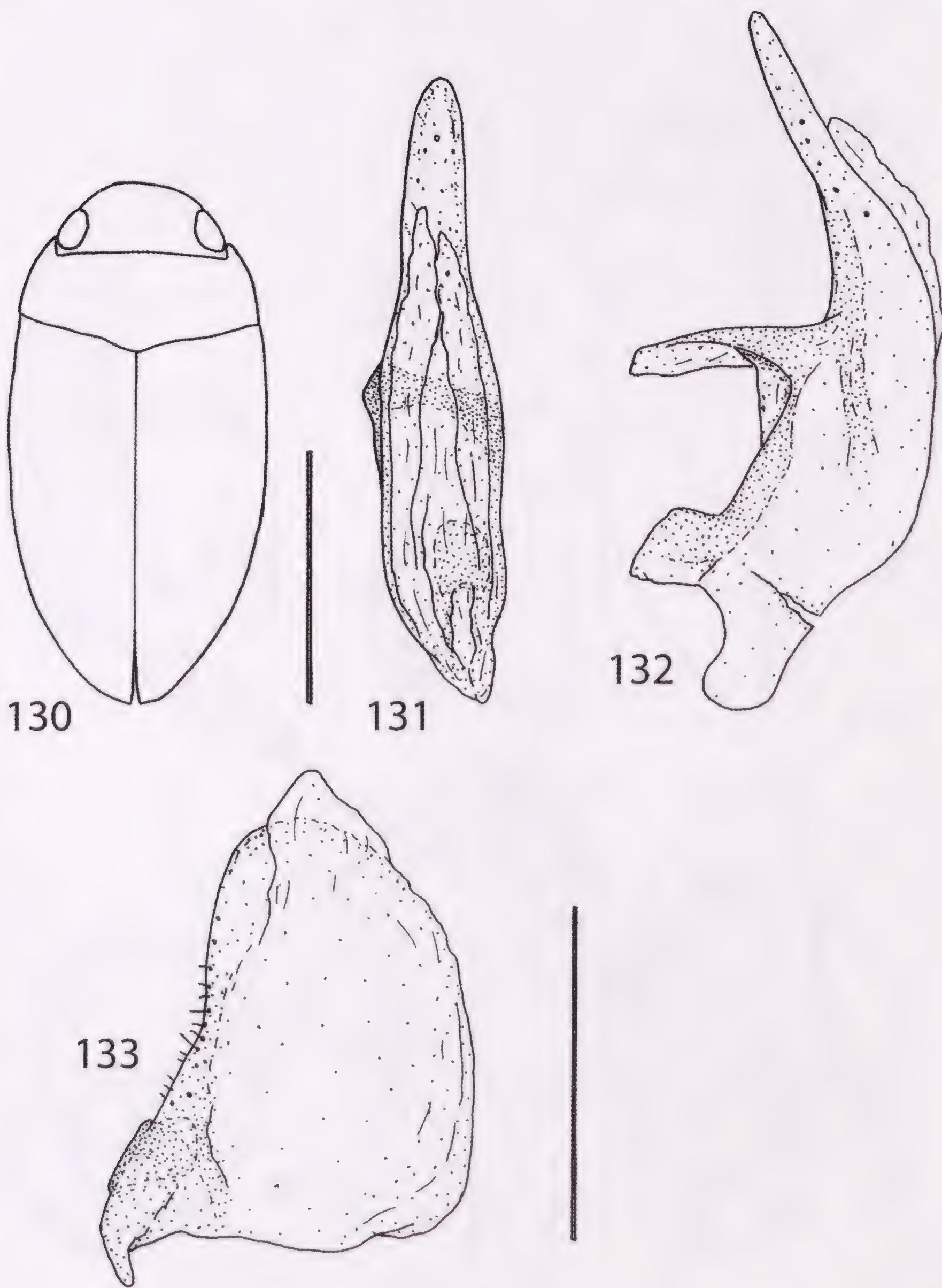
Figs 121-124. *Canthyporus loeffleri*: 121 - habitus, holotype, male; 122 - penis, ventral aspect; 123 - penis, lateral aspect; 124 - paramere, external aspect. Scale bars: 121 (1 mm), 122-124 (0.4 mm).





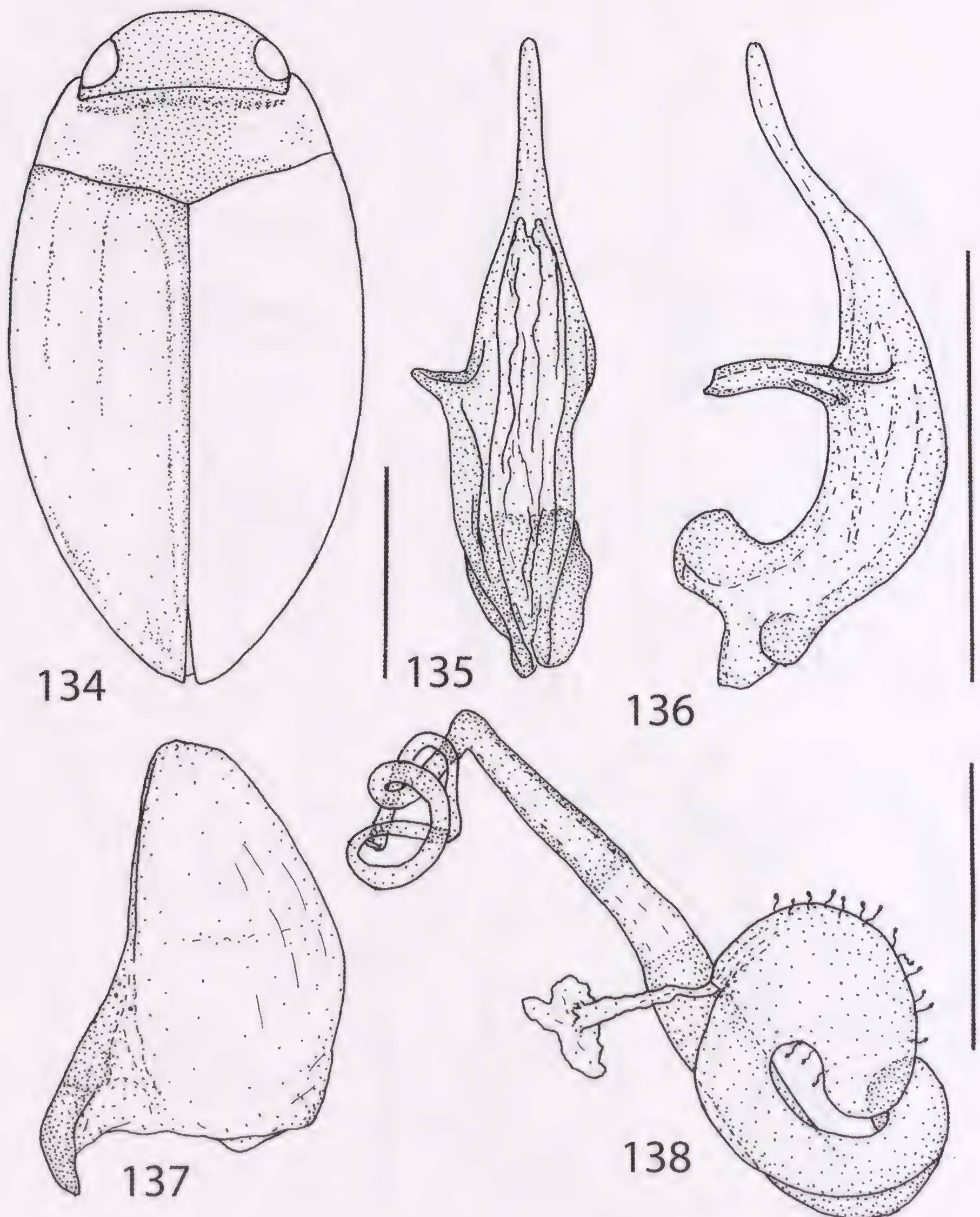
Figs 125-129. *Canthyporus lowryi*: 125 - habitus, paralectotype, female; 126 - metatibia and basal metatarsomeres, male, redrawn from Omer-Cooper (1965); 127 - penis, ventral aspect, ditto; 128 - penis, lateral aspect, ditto; 129 - spermathecal tract and parts of ductus, Sir Lowry's Pass near Somerset West. Scale bars: 125 (1 mm), 126-128 (no scale bar), 129 (0.2 mm).





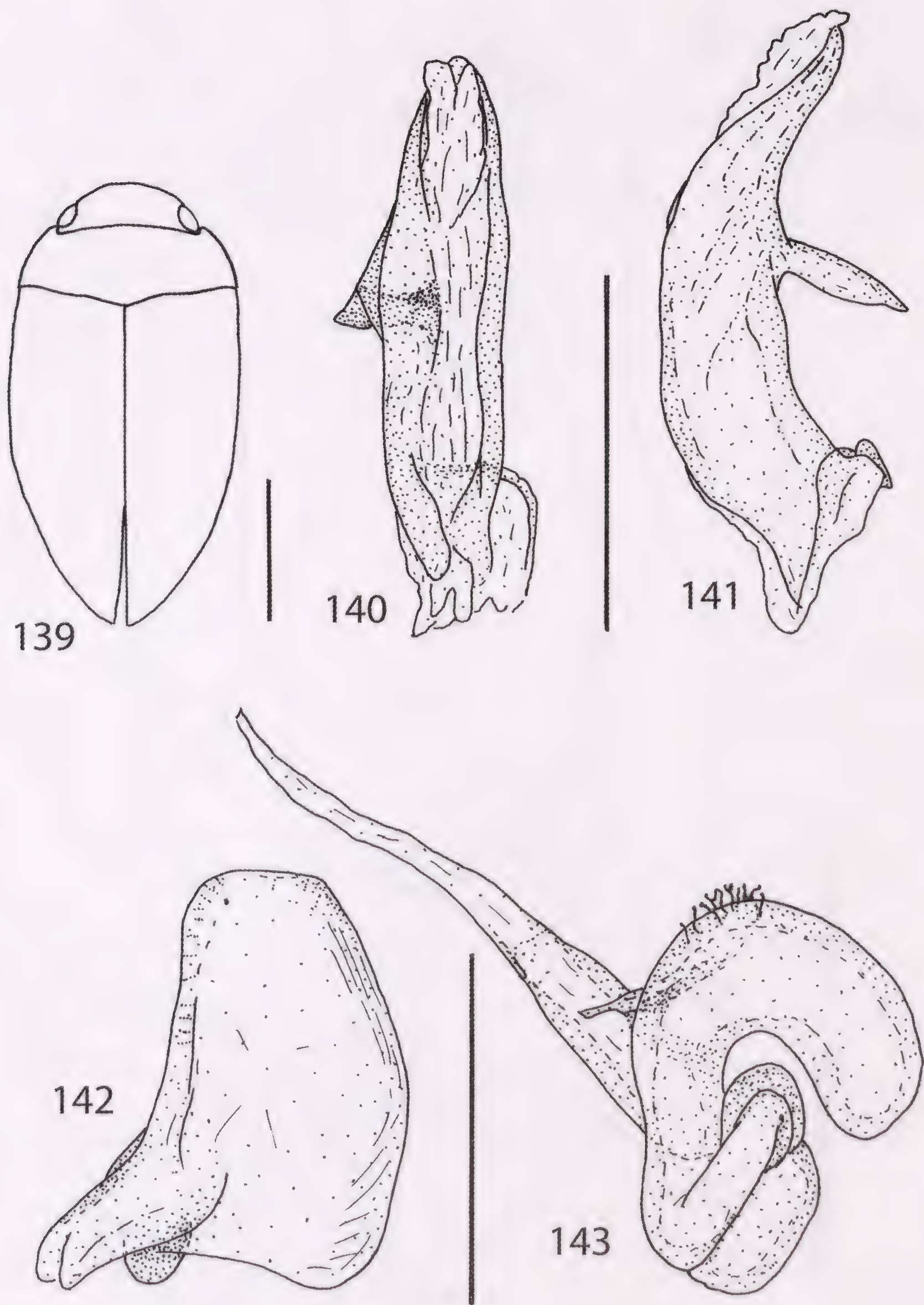
Figs 130-133. *Canthyporus pauliani*: 130 - habitus, holotype, male; 131 - penis, ventral aspect; 132 - penis, lateral aspect; 133 - paramere, external aspect. Scale bars: 130 (1 mm), 131-133 (0.2 mm).





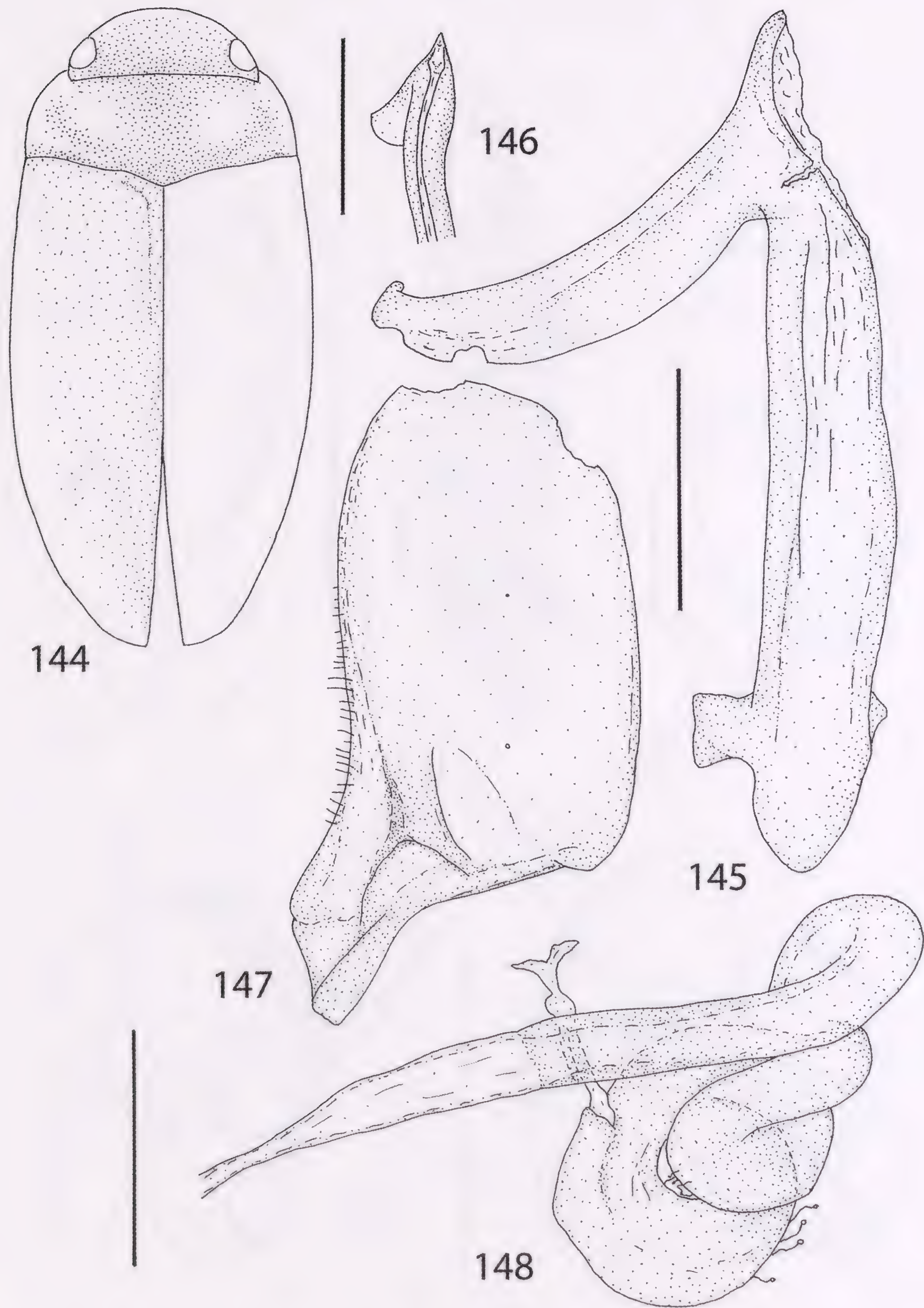
Figs 134-138. *Canthyporus petulans*: 134 - habitus, paratype, male; 135 - penis, ventral aspect; 136 - penis, lateral aspect; 137 - paramere, external aspect; 138 - spermathecal tract, Hawaquas. Scale bars: 134 (1 mm), 135-137 (0.4 mm), 138 (0.2 mm).





Figs 139-143. *Canthyporus planus*: 139 - habitus, Western Cape, male; 140 - penis, ventral aspect; 141 - penis, lateral aspect; 142 - paramere, external aspect; 143 - spermathecal tract, Swellendam. Scale bars: 139 (1 mm), 140-142 (0.4 mm), 143 (0.2 mm).





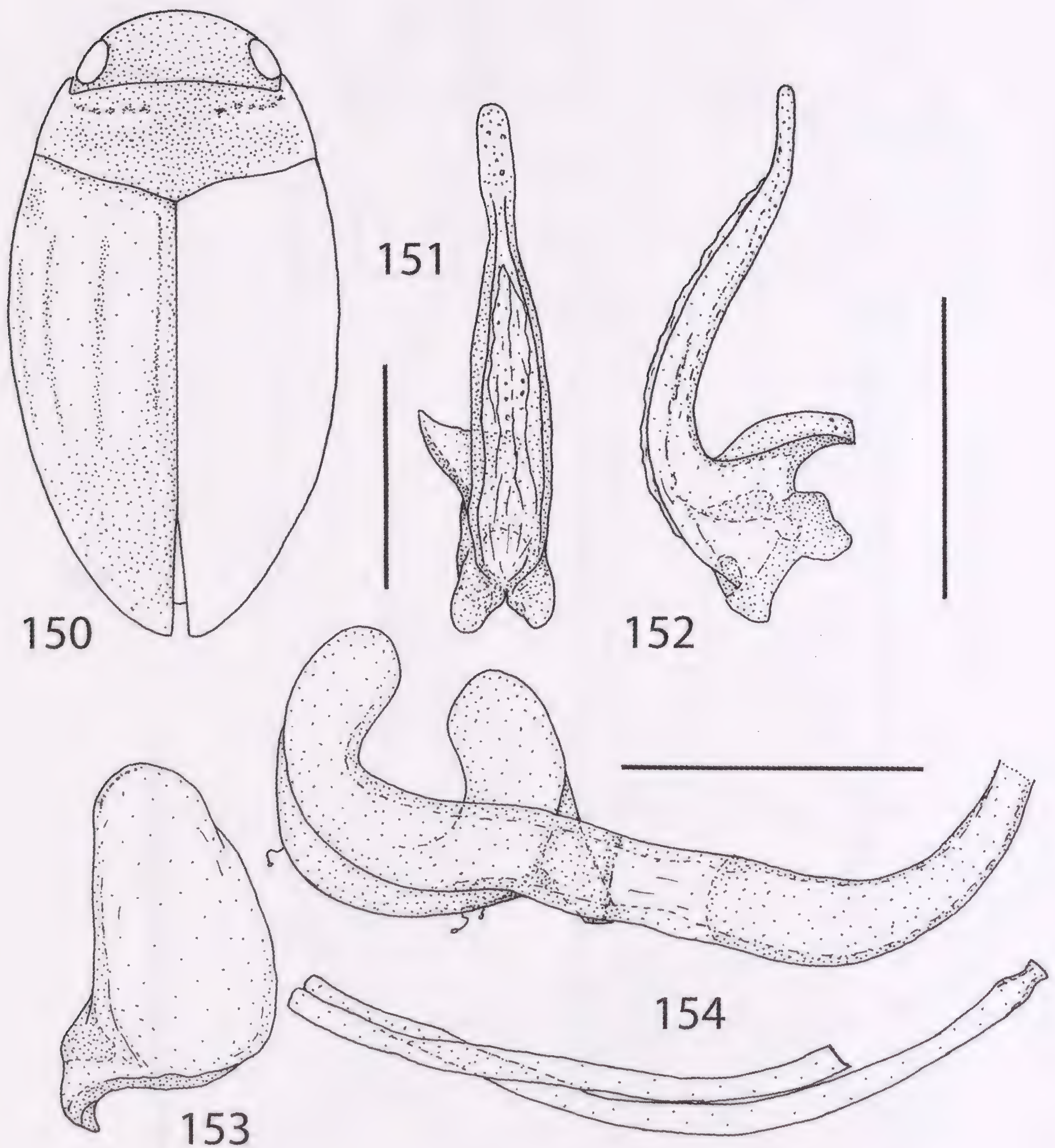
Figs 144-148. *Canthyporus sigillatus*: 144 - habitus, holotype, male; 145 - penis, ventral aspect, with apex twisted; 146 - penis apex, from alternative direction; 147 - paramere, external aspect; 148 - spermathecal tract, Uvira, Lac Lungwe. Scale bars: 144 and 146 (1 mm), 145 and 147 (0.4 mm), 148 (0.2 mm).





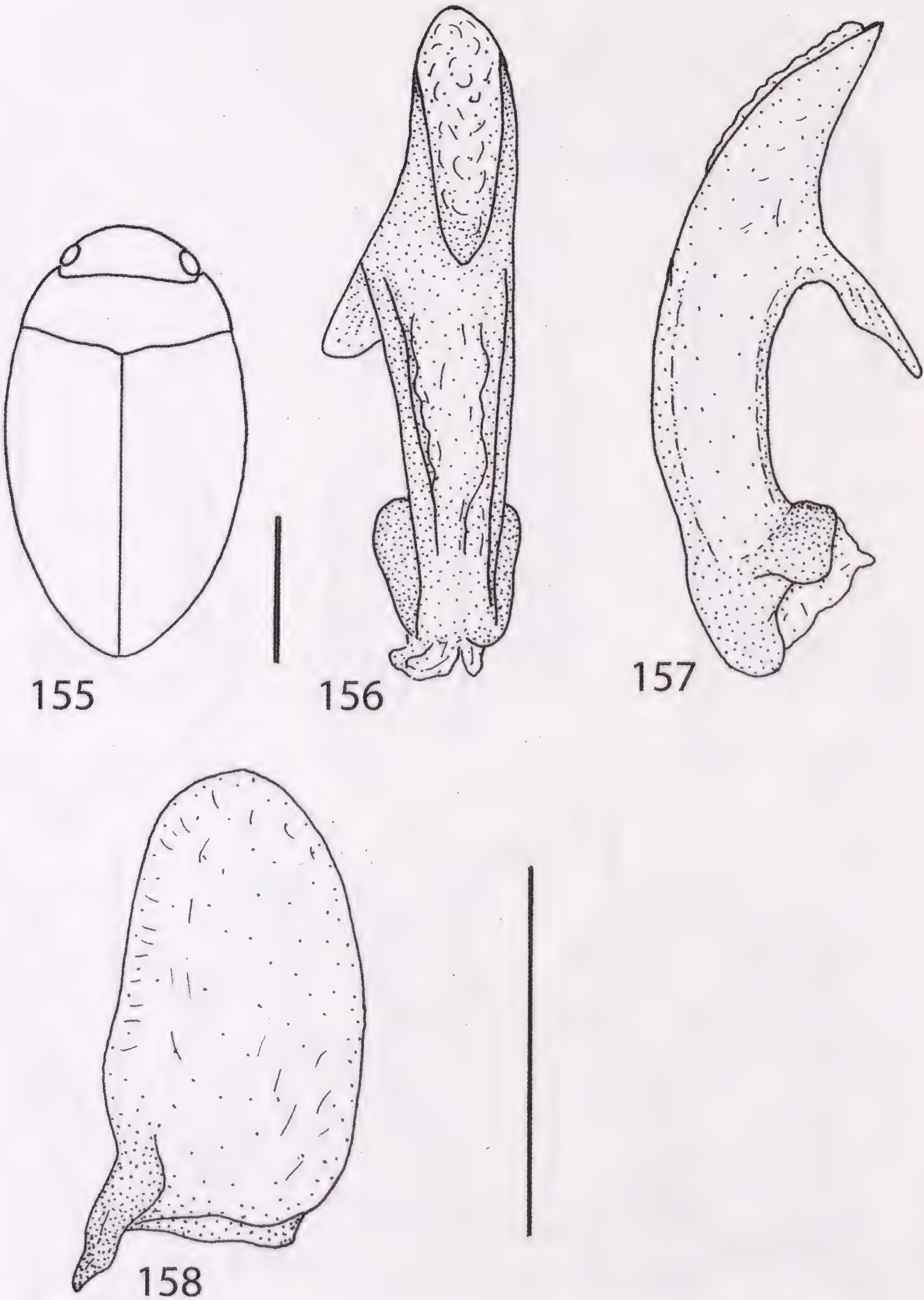
Fig. 149. *Canthyporus subparallelus*: Habitus, holotype, female. Scale bar: 1 mm.





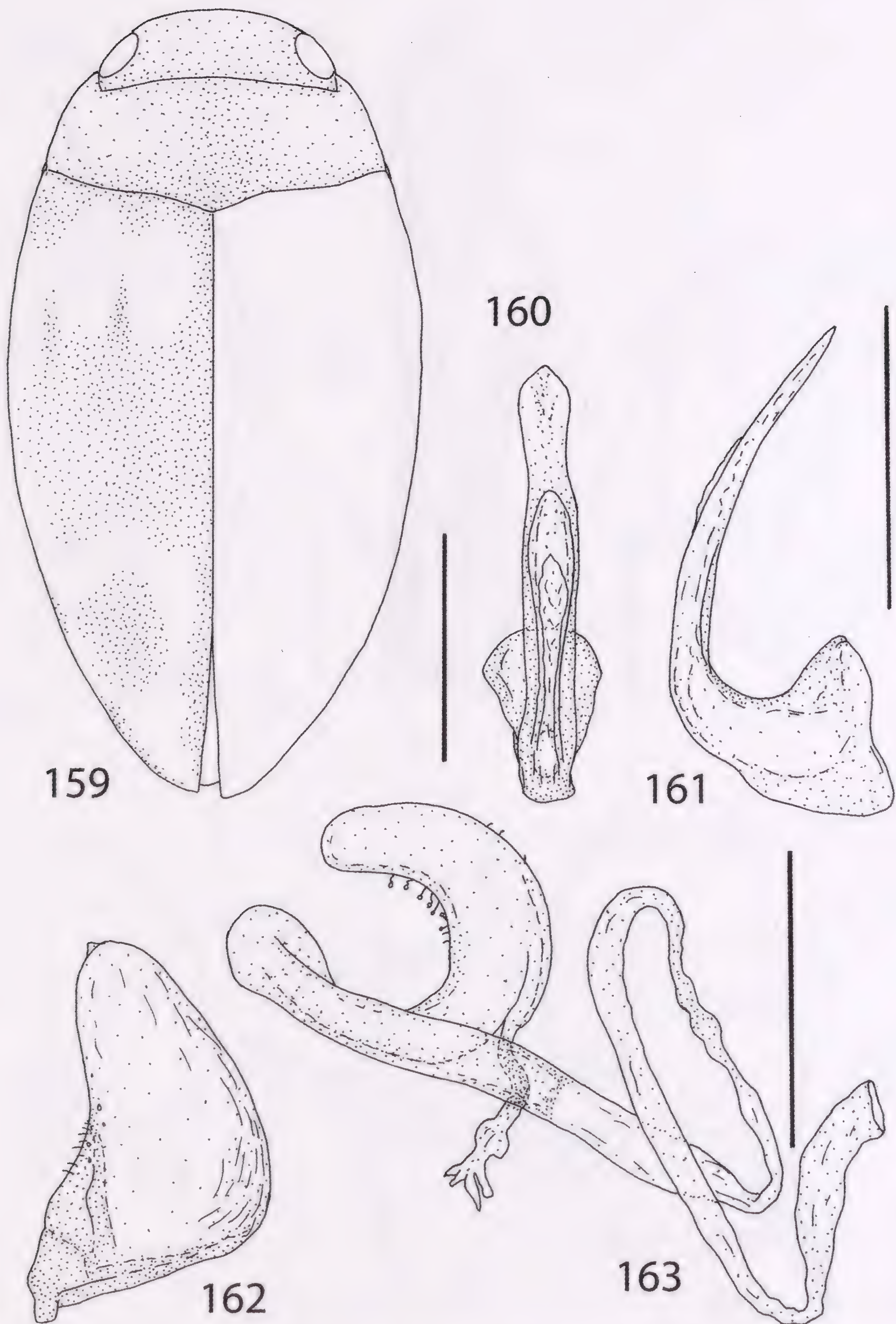
Figs 150-154. *Canthyporus swaziensis*: 150 - habitus, holotype, male; 151 - penis, ventral aspect; 152 - penis, lateral aspect; 153 - paramere, external aspect; 154 - spermathecal tract and parts of ductus, Inyanga. Scale bars: 150 (1 mm), 151-153 (0.4 mm), 154 (0.2 mm).





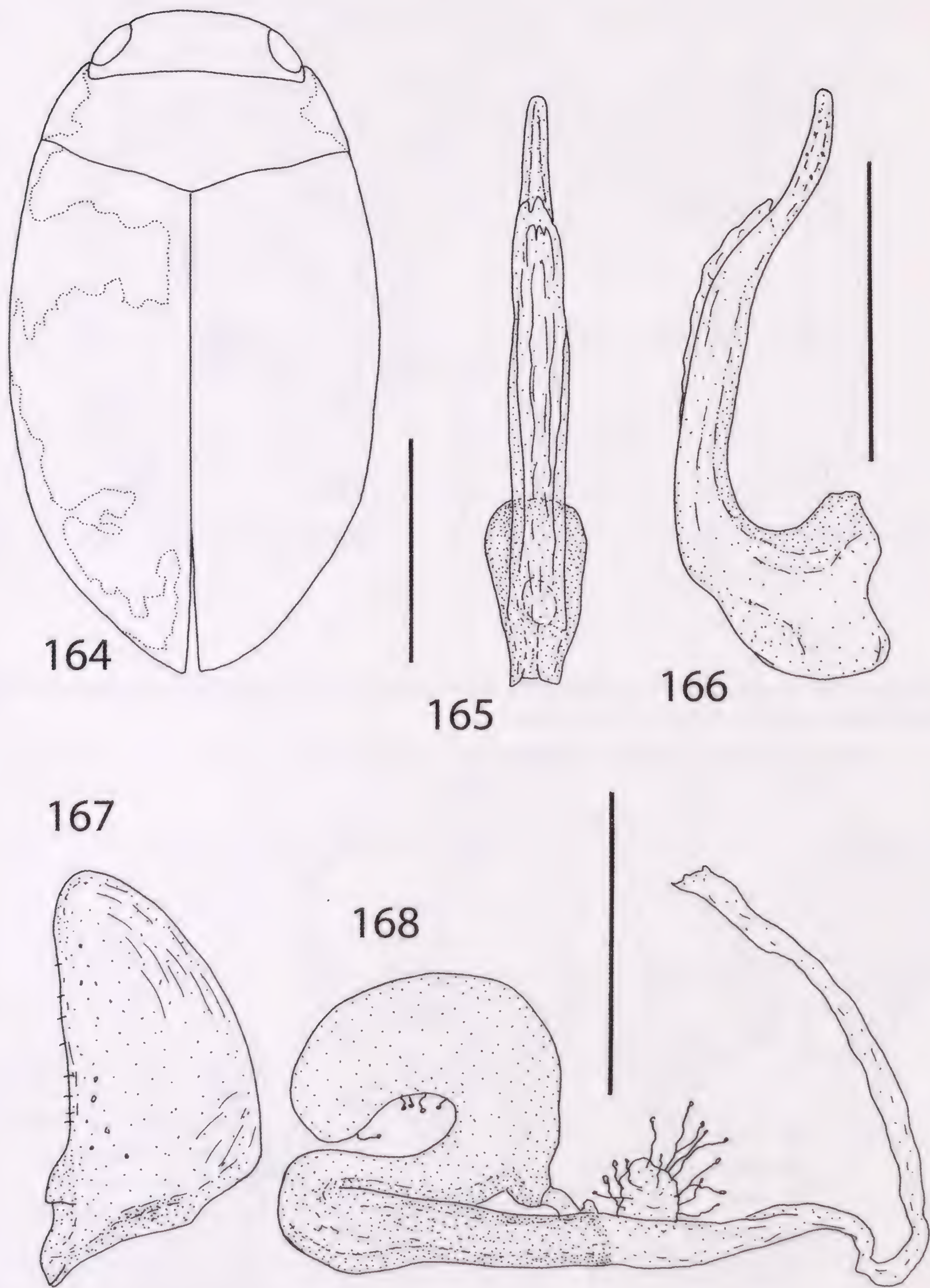
Figs 155-158. *Canthyporus turneri*: 155 - habitus, holotype, male; 156 - penis, ventral aspect; 157 - penis, lateral aspect; 158 - paramere, external aspect. Scale bars: 155 (1 mm), 156-158 (0.4 mm).





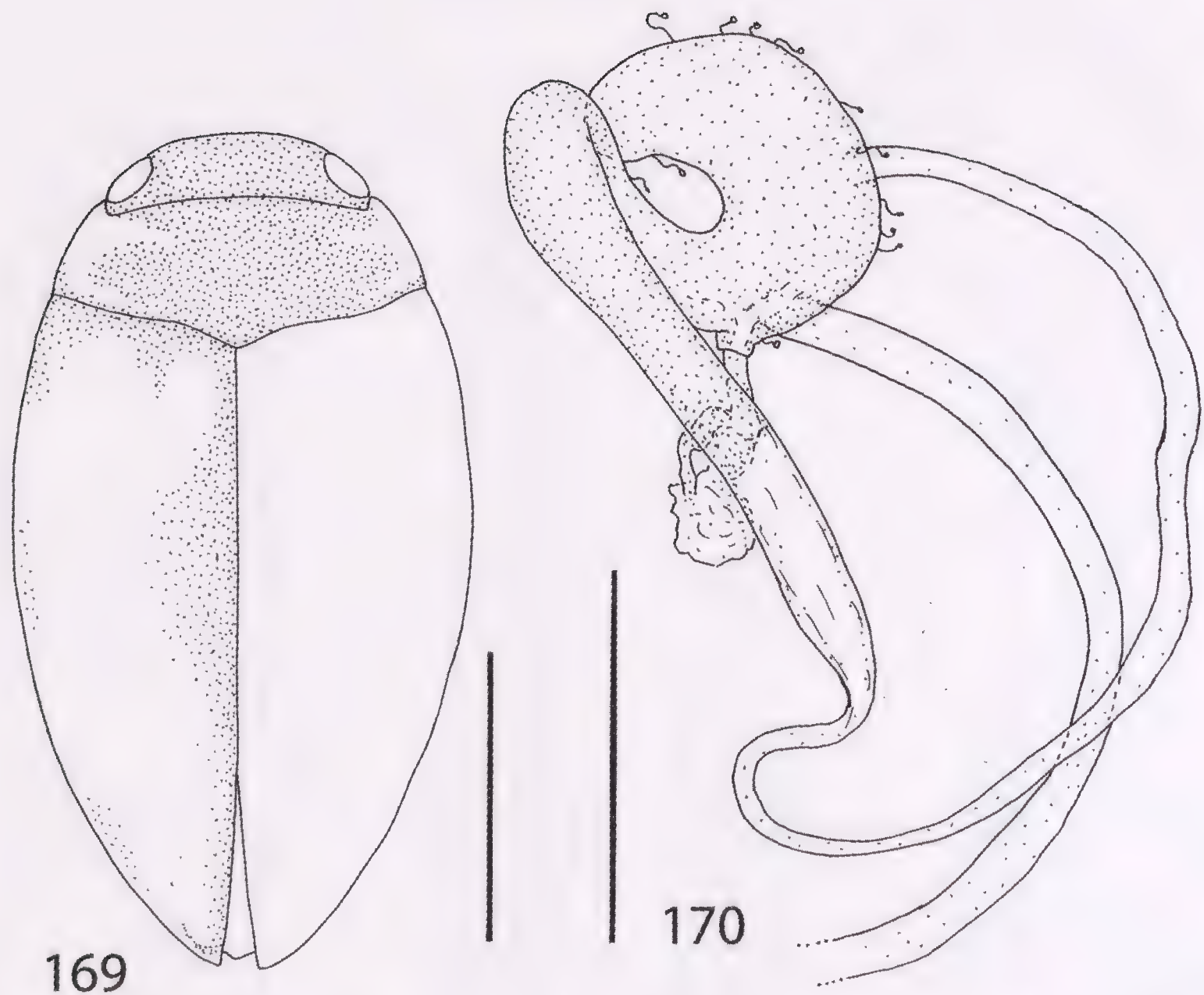
Figs 159-163. *Canthyporus bicinctus*: 159 - habitus, male, Cape, Cederberg; 160 - penis, ventral aspect; 161 - penis, lateral aspect; 162 - paramere, external aspect; 163 - spermathecal tract, Cederberg. Scale bars: 159 (1 mm), 160-162 (0.4 mm), 163 (0.2 mm).





Figs 164-168. *Canthyporus lateralis*: 164 - habitus, lectotype, female; 165 - penis, ventral aspect; 166 - penis, lateral aspect; 167 - paramere, external aspect; 168 - spermathecal tract, Caffraria. Scale bars: 164 (1 mm), 165-167 (0.4 mm), 168 (0.2 mm).





Figs 169-170. *Canthyporus regimbarti*: 169 - habitus, holotype, female; 170 - spermathecal tract, Cape. Scale bars: 169 (1 mm), 170 (0.2 mm).

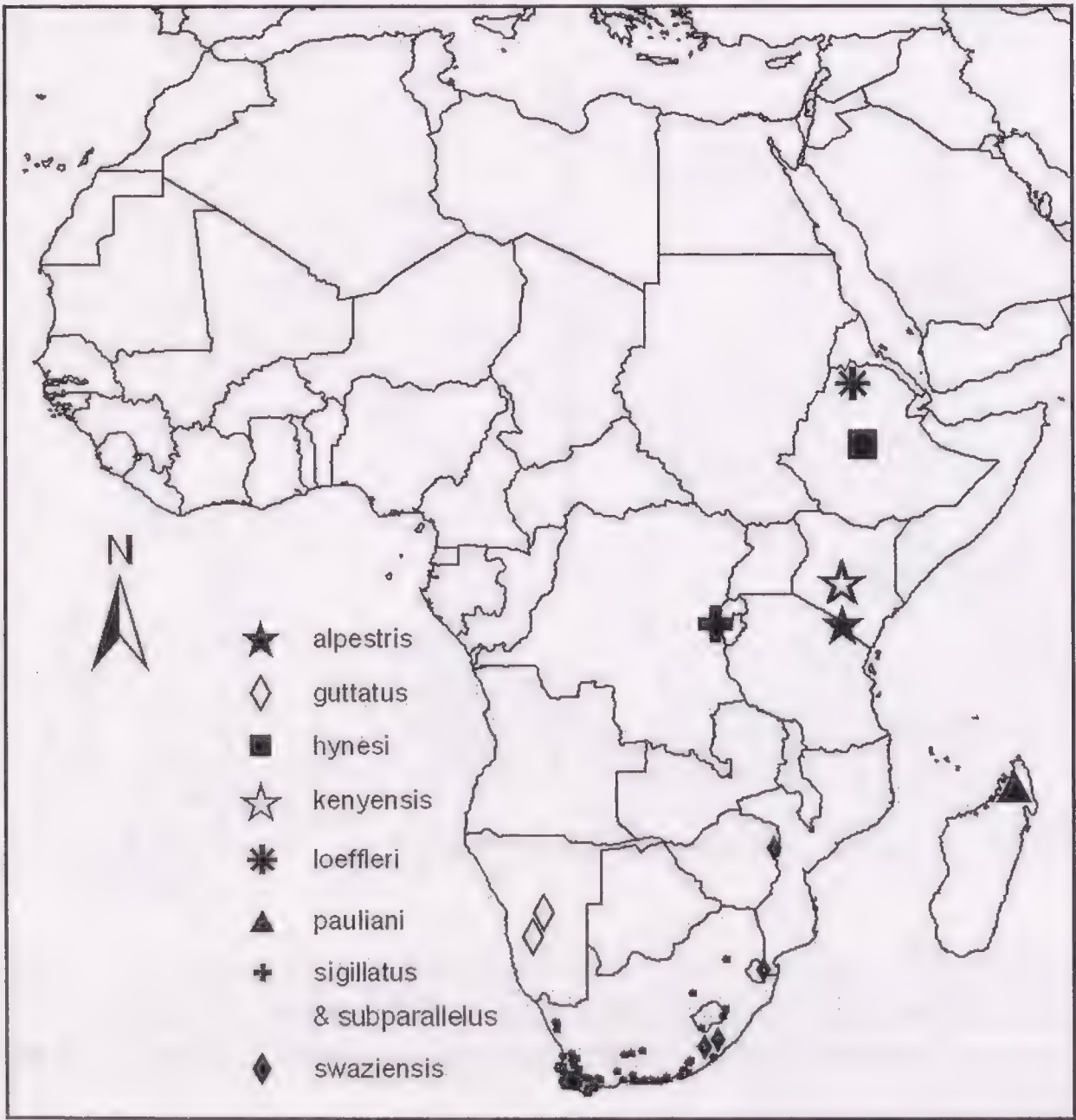


Fig. 171. Map of Africa with known records of *Canthyporus alpestris*, *C. guttatus*, *C. hynesi*, *C. kenyensis*, *C. loeffleri*, *C. pauliani*, *C. sigillatus*, *C. subparallelus*, *C. swaziensis*, and (•) South African species pooled. Note that *C. sigillatus* and *C. subparallelus* are represented by a single symbol since the individual records of the two species are relatively close.



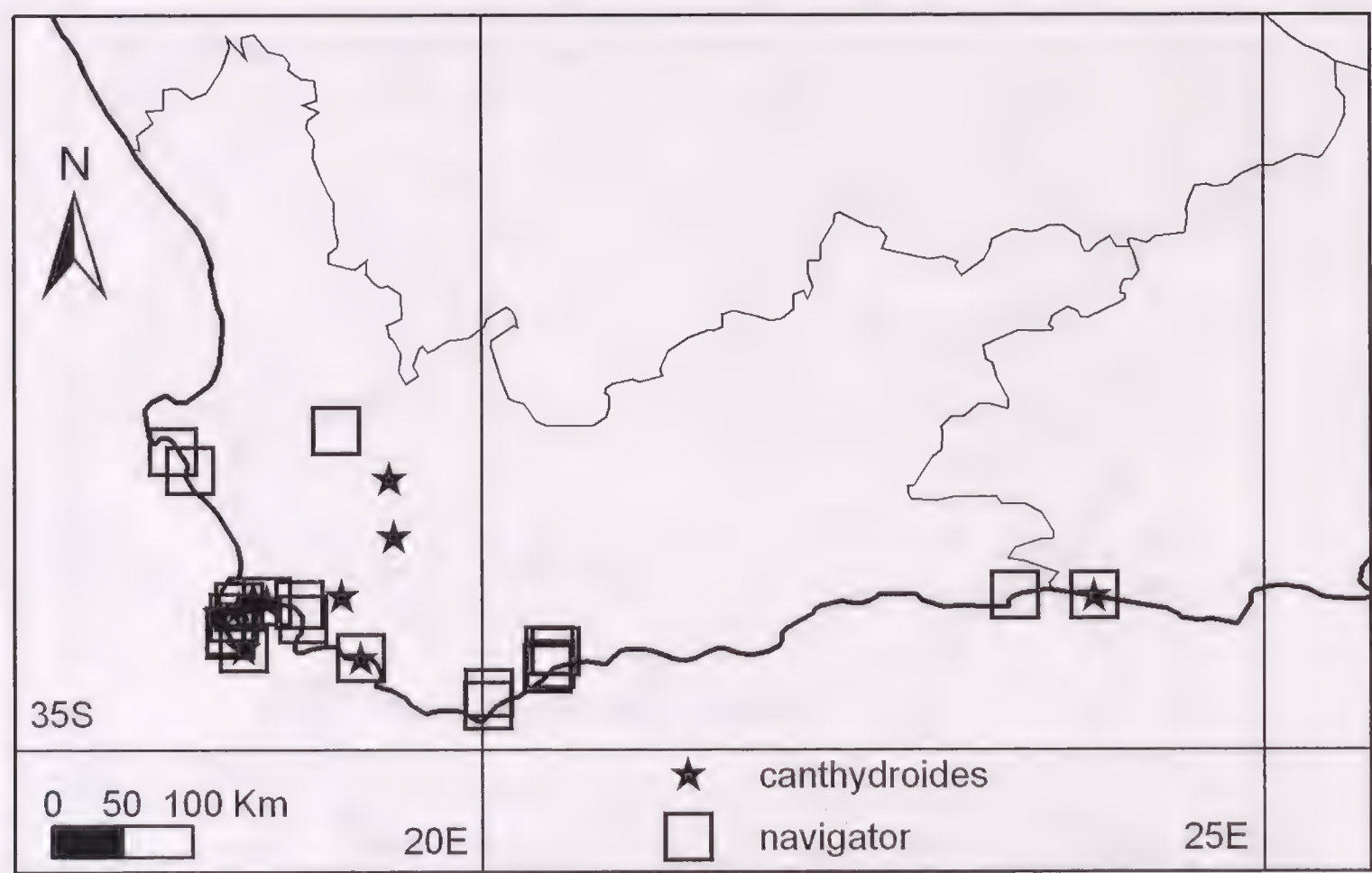


Fig. 172. Map of Western Cape with known records of *Canthyporus canthydroides* and *C. navigator*.

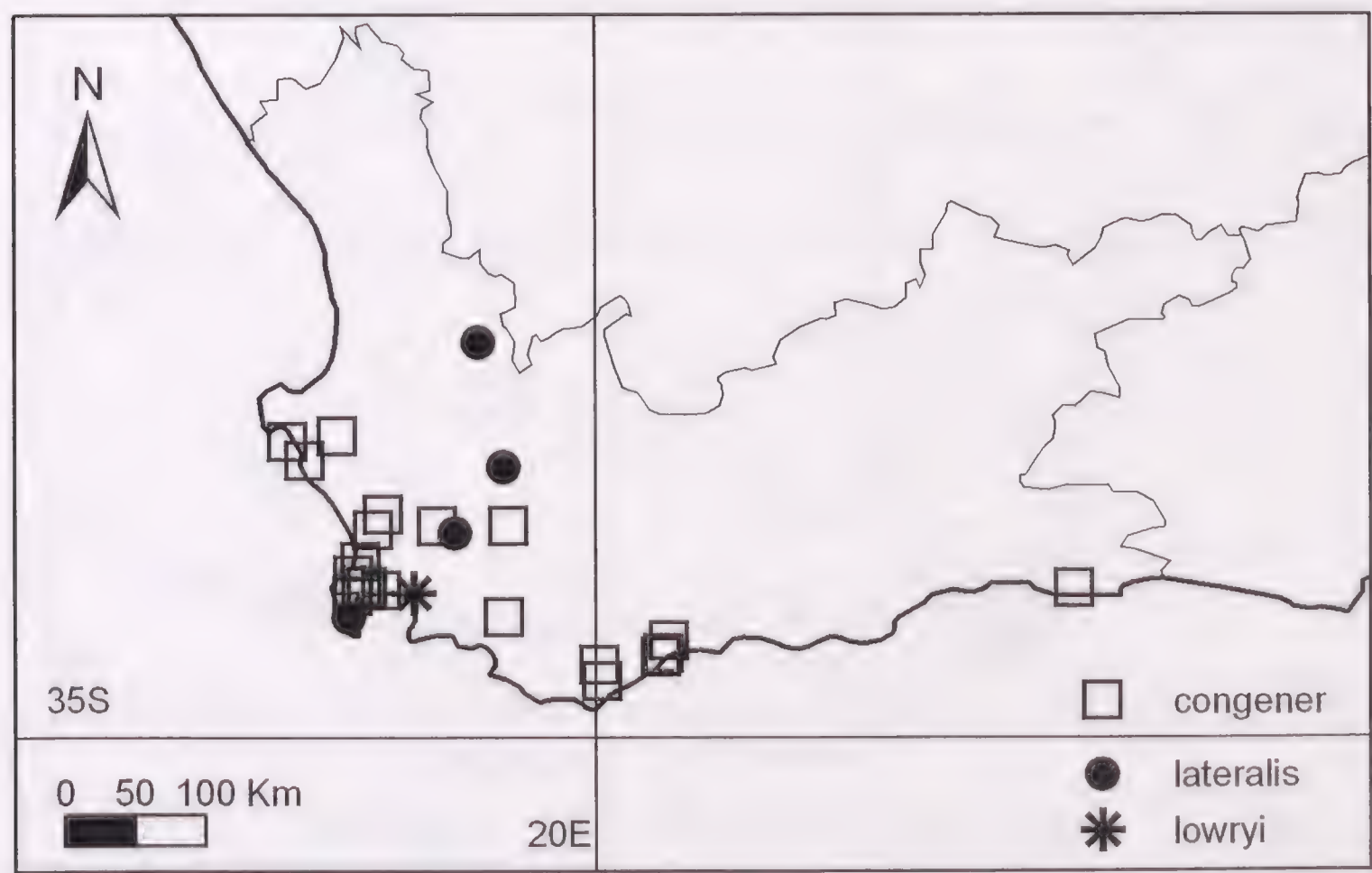


Fig. 173. Map of Western Cape with known records of *Canthyporus congener*, *C. lateralis*, and *C. lowryi*.



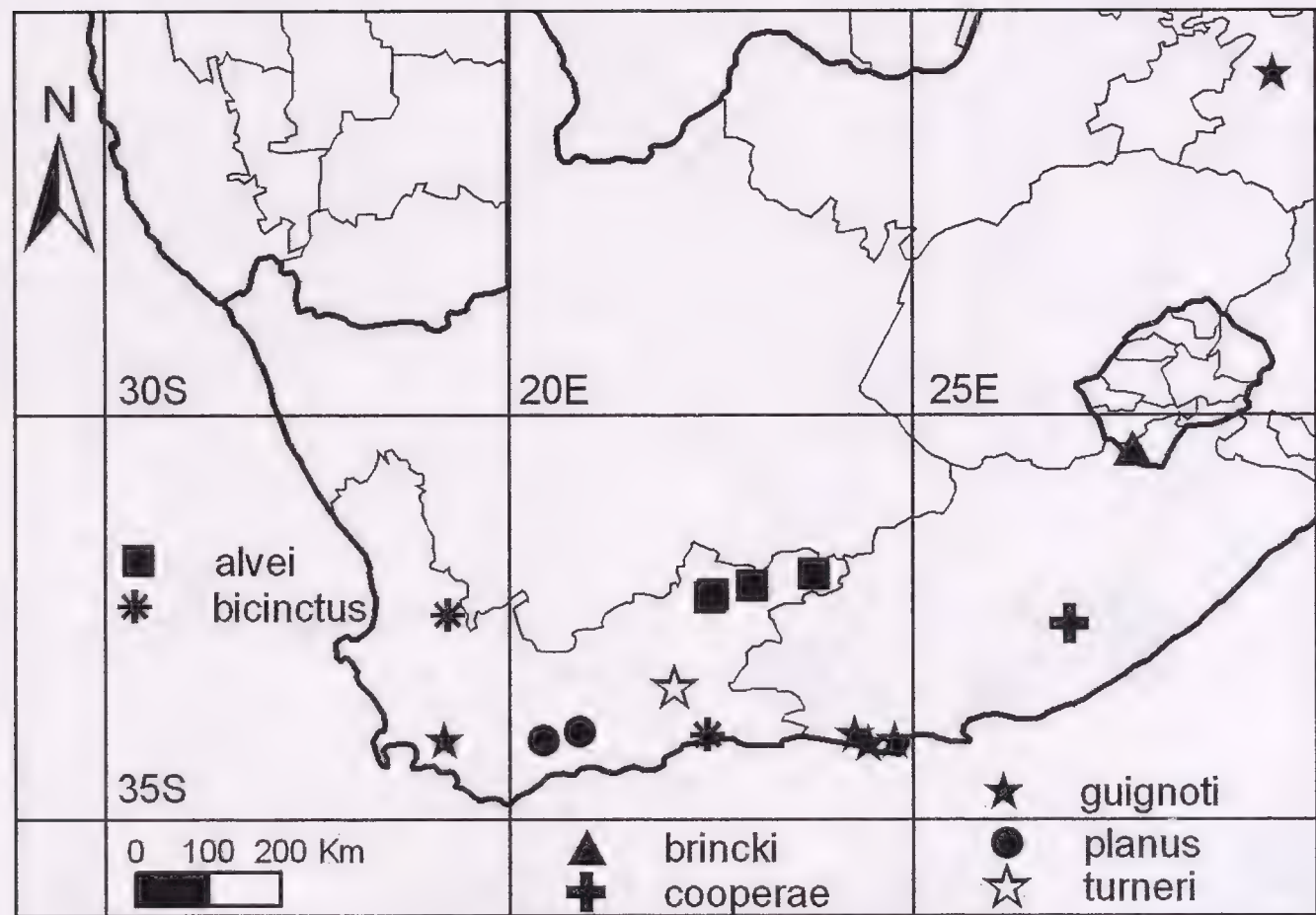


Fig. 174. Map of South Africa with known records of *Canthyporus alvei*, *C. bicinctus*, *C. brincki*, *C. cooperae*, *C. guignoti*, *C. petulans*, *C. planus*, and *C. turneri*.

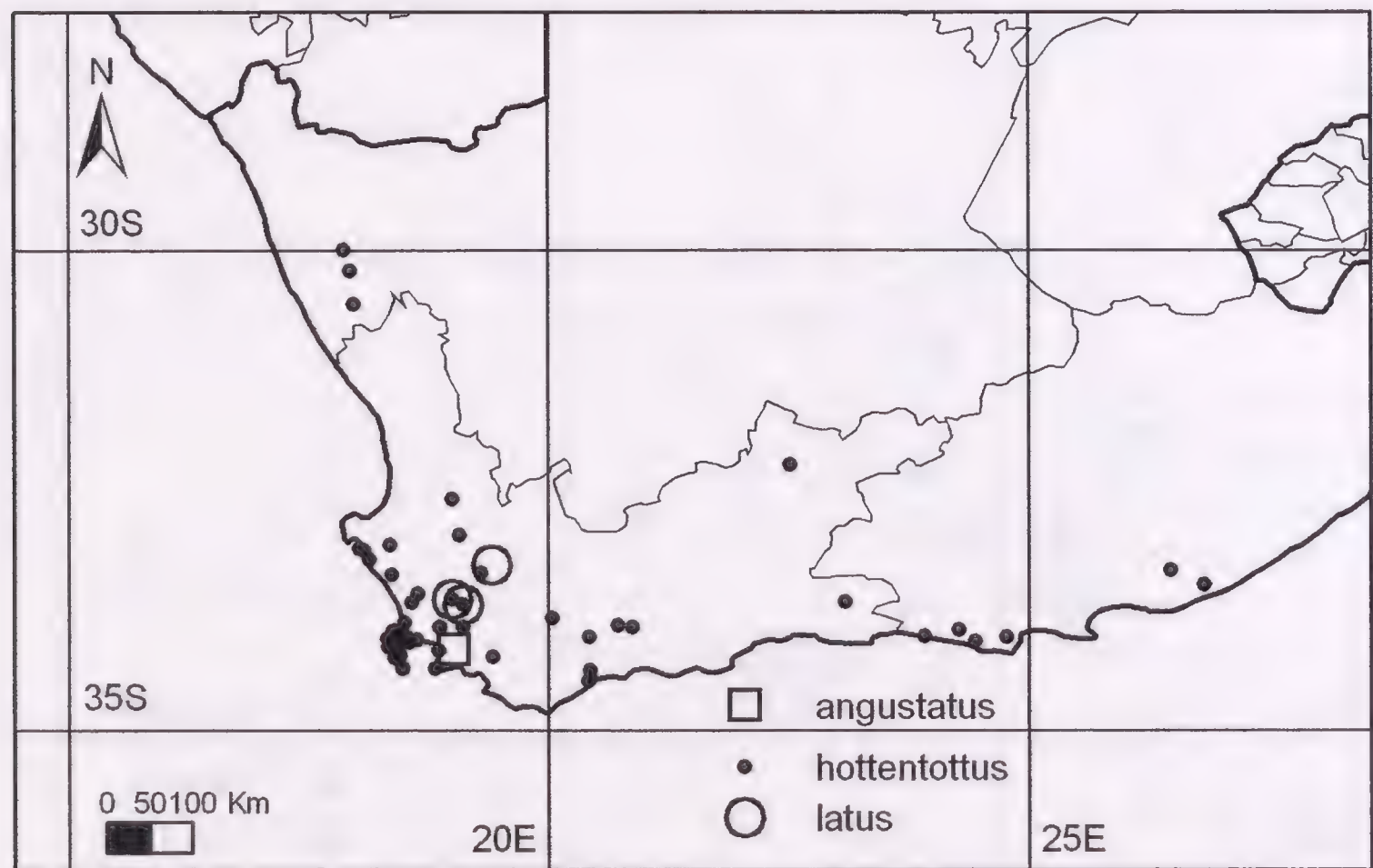


Fig. 175. Map of South Africa with known records of *Canthyporus angustatus*, *C. hottentottus*, and *C. latus*.



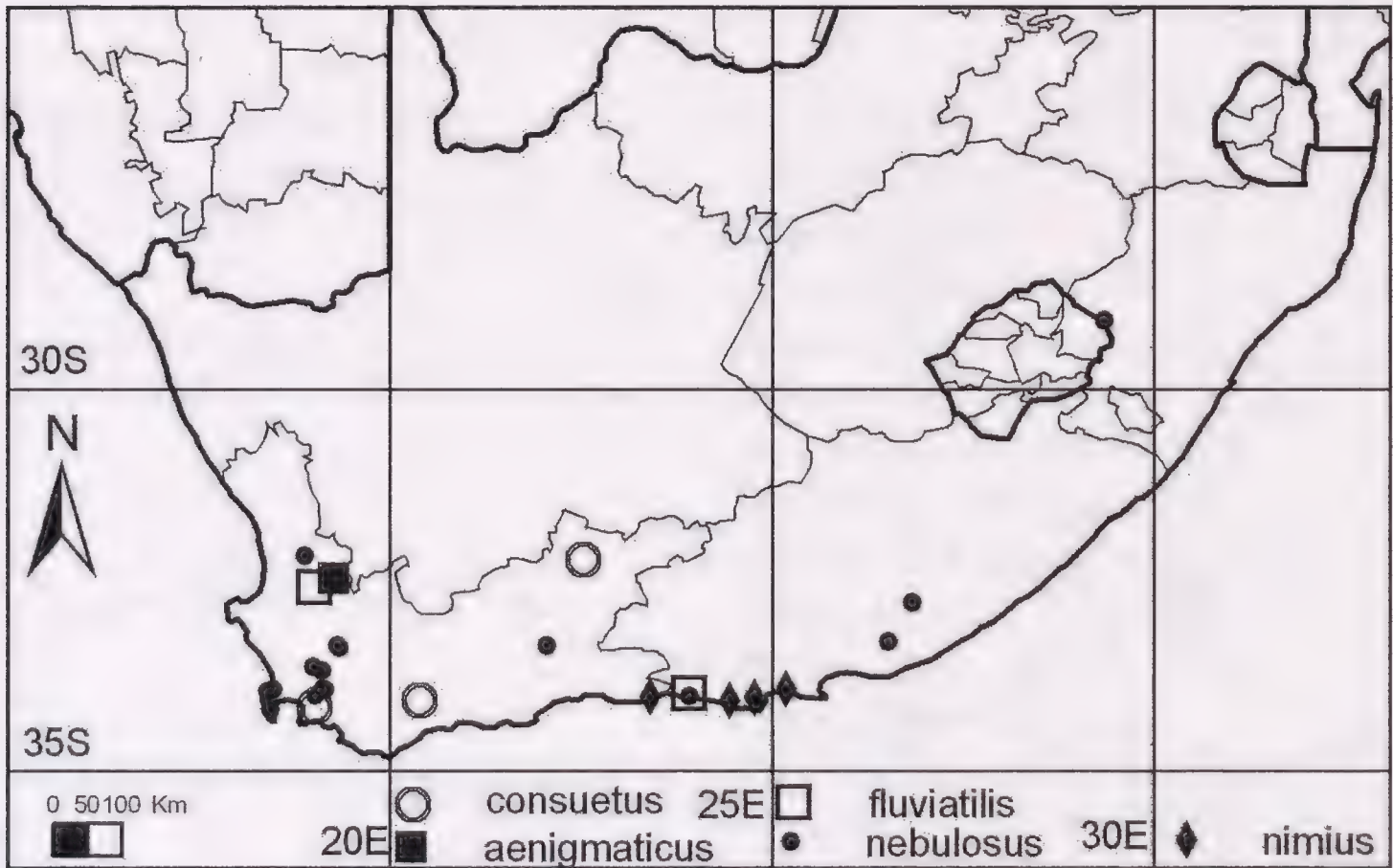


Fig. 176. Map of South Africa with known records of *Canthyporus consuetus*, *C. aenigmaticus*, *C. fluviatilis*, *C. nebulosus*, and *C. nimius*.

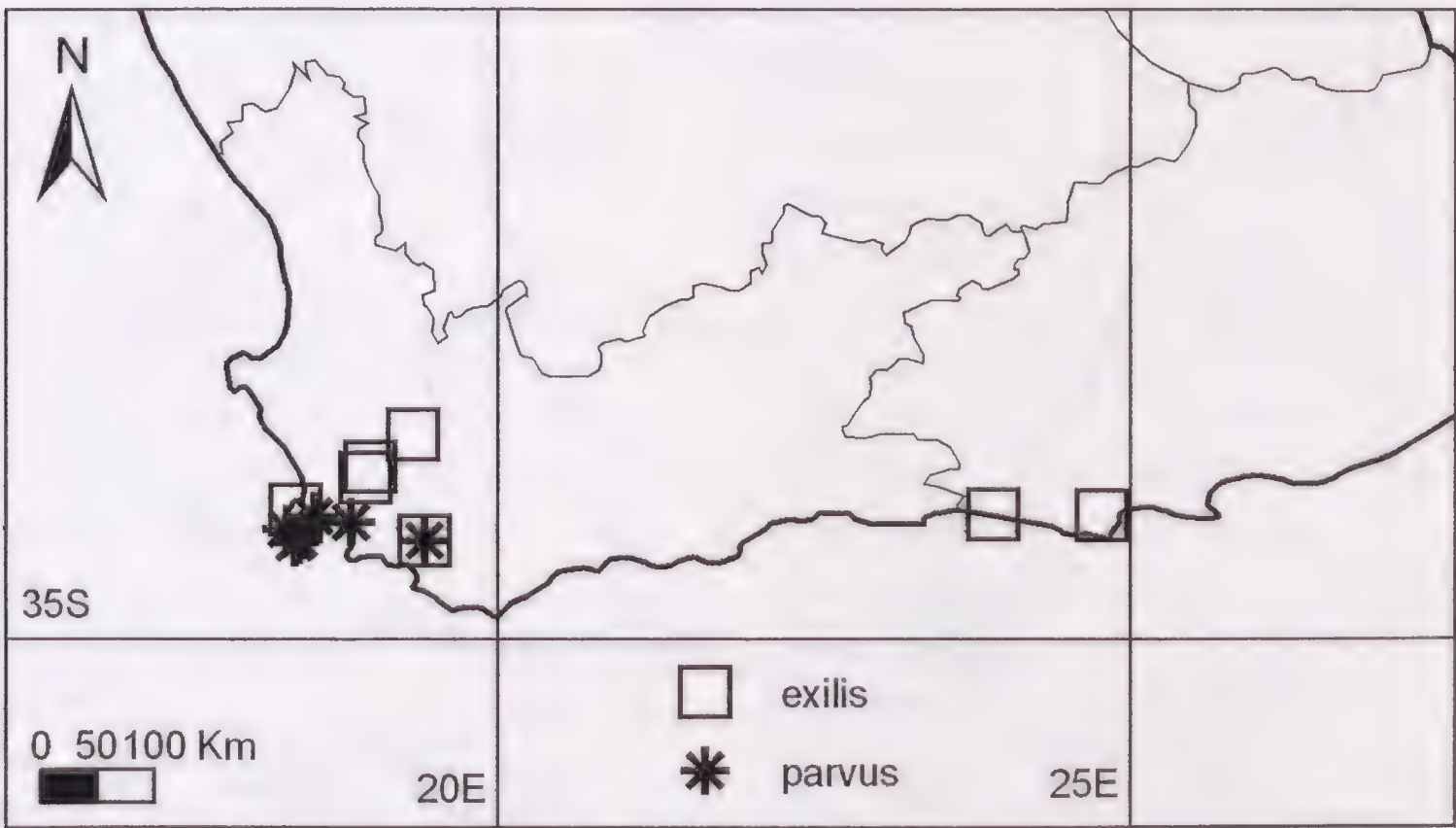


Fig. 177. Map of Western Cape with known records of *Canthyporus exilis* and *C. parvus*.



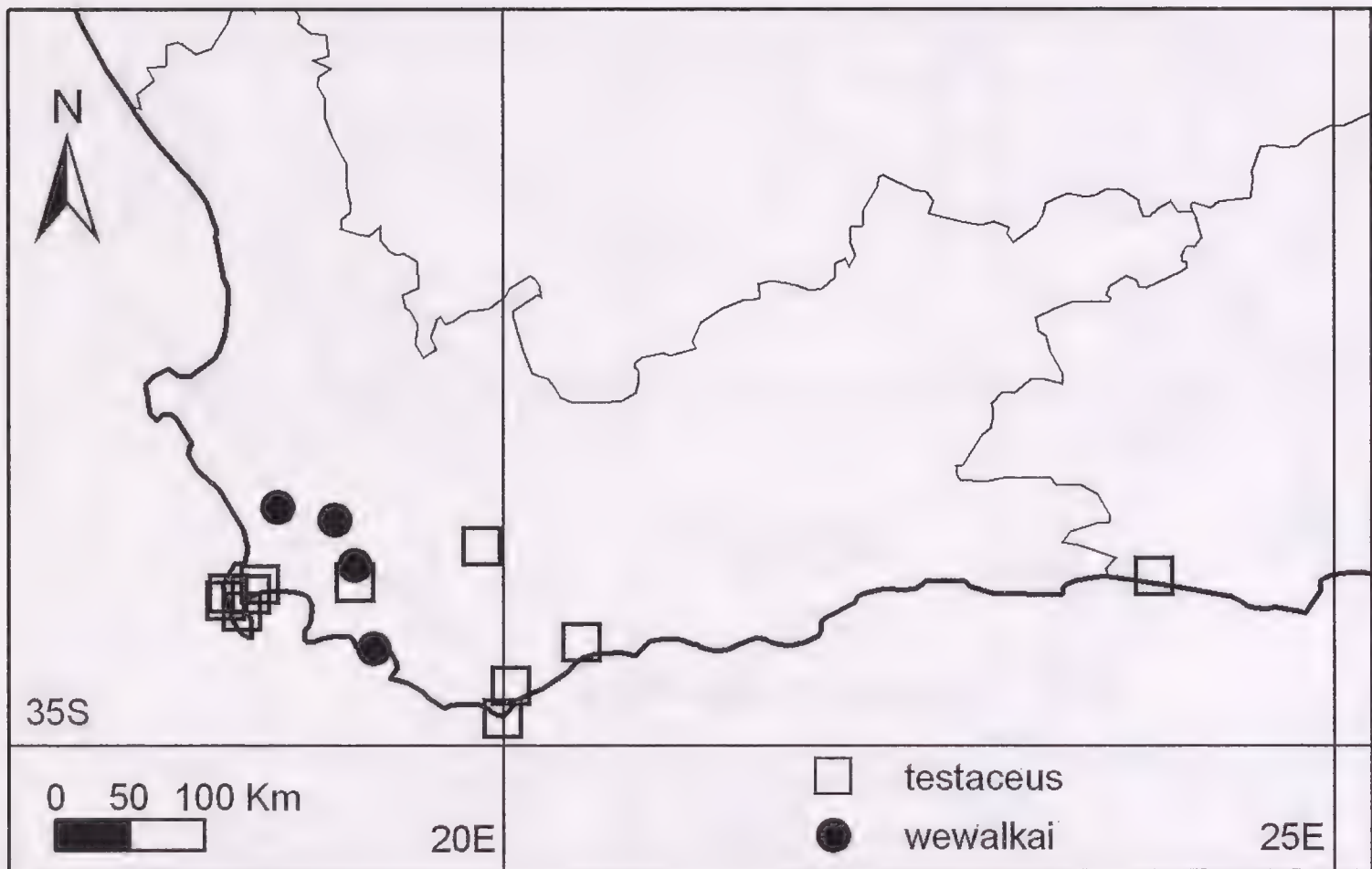


Fig. 178. Map of Western Cape with known records of *Canthyporus testaceus* and *C. wewalkai*.

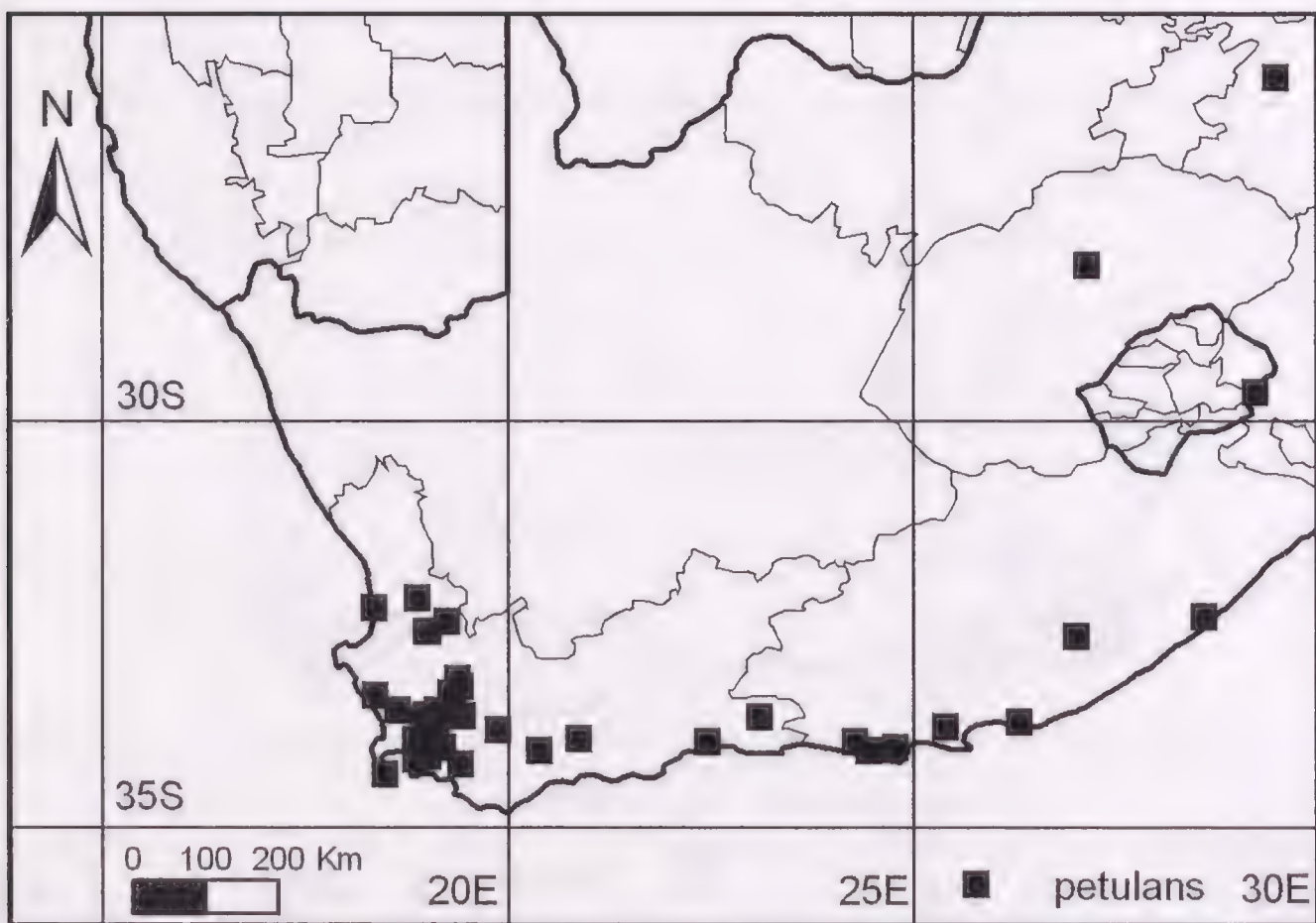


Fig. 179. Map of South Africa and Lesotho with known records of *Canthyporus petulans*.



Appendix 1. Decimal latitude (N positive) and longitude (E positive) of all mapped localities.

**Democratic Republic of the Congo**

Lake Lungwe -3.045, 28.812

Muhi Mt. -2.936, 28.822

**Ethiopia**

Dima River 9.133, 38.769

Simen 13.231, 38.127

**Kenya**

Halltarn -0.130, 37.424

Hooktarn -0.130, 37.424

Mount Kenya -0.134, 37.326

**Lesotho**

Quthing -30.411, 27.717

Sani Pass -29.655, 29.208

**Madagascar**

Lac Combes -14.022, 48.992

Tsaratanana Mt. -14.022, 48.992

**Namibia**

Naukluft -24.254, 16.272

Windhoek -22.555, 17.080

**South Africa**

**Eastern Cape**

Adelaide -33.703, 26.299

Amatola -32.792, 26.836

Bathurst -33.482, 26.831

Engcobo -31.666, 27.999

Gaileskloof -33.332, 26.491

Grahamstown -33.305, 26.523

Hogsback Mt. -32.584, 26.950

Humansdorp -34.026, 24.776

Karredouw -33.948, 24.281

Katberg -32.656, 27.005

Matatiele -32.412, 28.580

Qumbu -31.150, 28.868

Storms River -33.981, 23.920

Tzizikama Forest -34.017, 23.919

Uitenhage -33.764, 25.393

Van Stadens Pass -33.917, 25.198

Witte-els-bosch -34.066, 24.449

**Free State**

Ventersburg -28.088, 27.143

**Kwazulu-Natal**

Champagne Castle -29.090, 29.353

**Mpumalanga**

Middleburg -25.769, 29.471

**Northern Cape**

Garies -30.555, 17.979

Kamieskroon -30.207, 17.940

Mesklip -29.993, 17.877

**Western Cape**

Abrahamskraal -33.219, 18.141

Alfreds Berg Pass -33.267, 19.417

Ashton -33.825, 20.046

Bainskloof -33.625, 18.999

Barrydale -33.899, 20.732

Blinkwater Falls -33.953, 18.390

Bredasdorp -34.533, 20.033

Breede River -34.063, 20.385

Caledon -34.225, 19.421

Cape Agulhas -34.836, 20.000

Cape Point -34.351, 18.483

Cape Town -34.351, 18.483

Cedarberg -32.471, 19.255

Chapmansbay -34.086, 18.349

Citrusdal -32.590, 19.002

Clanwilliam -32.179, 18.886

Concordia -34.041, 23.071

Darling -33.376, 18.367

De Hoop -34.457, 20.440

De Hoop Vlei -34.482, 20.424

Devils Peak -33.929, 18.465

Disa River -34.023, 18.358

Du Toit's Kloof -34.005, 19.014

Du Toits Mts -33.931, 19.141

Dwarfsberge -34.040, 19.026

Elandsbay -32.299, 18.349

Firgrove -34.054, 18.634

Fransch Hoek -33.915, 19.115

George -33.959, 22.468

Glencairn Vlei -34.158, 18.416

Gordon's Bay -34.167, 18.864

Grabouw -34.153, 19.011

Guydo Pass -33.178, 19.388

Hawaquas -33.686, 19.109

Helderfontein -33.920, 20.880

Hermanus -34.414, 19.230

Heunignes River -34.722, 20.041

Hex River Mts. -33.385, 19.329

Hopefield -33.063, 18.353

Hout Bay -34.040, 18.351

Kalabaskraal -33.568, 18.648

Kalk Bay Peak -34.224, 18.424

Karoo NP mountain view -32.224, 22.521



Kasteelspoort River -33.965, 18.378  
 Kirstenbosch -34.077, 18.400  
 Kommetjie -34.129, 18.335  
 Krom River -33.923, 18.865  
 Lakeside -34.089, 18.452  
 Langebaan -33.098, 18.033  
 Limiet Berge -33.563, 19.162  
 Malgas -34.376, 20.476  
 Milnerton -33.868, 18.499  
 Mitchell's Pass -33.358, 19.304  
 Montague Pass -33.956, 22.459  
 Mooimark -33.118, 18.084  
 Murraysburg -31.967, 23.766  
 Nelspoort -32.114, 23.007  
 Nuweberg -34.016, 19.111  
 Oatlands -34.212, 18.456  
 Olifantbos -34.263, 18.396  
 Olifants River -32.599, 19.018  
 Orankekloof -34.043, 18.329  
 Ottery -34.016, 18.509  
 Ouplas -34.367, 20.434  
 Paarl -33.723, 18.955  
 Philadelphia -33.666, 18.582  
 Philippi -34.031, 18.544  
 Plettenberg Bay -34.016, 23.412  
 Prince Alfreds Pass -33.654, 23.099  
 Princess Vlei -34.090, 18.488  
 Pringle Bay -34.348, 18.818  
 Puttersvlei -32.253, 22.491

Ratel River -32.965, 19.075  
 Robertson -33.800, 19.878  
 Rondebosch -33.954, 18.455  
 Rondevlei -34.242, 18.397  
 Schusters Kraal -34.219, 18.425  
 Simonstown -34.193, 18.432  
 Sir Lowry's Pass -34.076, 18.841  
 Skeleton Gorge -33.973, 18.475  
 Somerset West -34.076, 18.841  
 Stellenbosch -33.923, 18.865  
 Strandfontein -34.080, 18.549  
 Swartberg Pass -33.356, 22.054  
 Swellendam -34.023, 20.431  
 Table Mt. -33.981, 18.401  
 Tafelberg -33.981, 18.401  
 Theewaterskloof -34.029, 19.202  
 Tweede -33.569, 19.135  
 Wellington -33.640, 18.991  
 Viloenspas -34.128, 19.017  
 Worcester -33.641, 19.446  
 Wynberg -34.017, 18.451  
 Zekoevlei -34.638, 20.049

#### **Swaziland**

Stegi -26.454, 31.951

#### **Tanzania**

Kilimandjaro -3.056, 37.361

#### **Zimbabwe**

Inyanga -18.216, 32.750

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Yves ALARIE &amp; Samantha HUGHES

## Re-descriptions of larvae of *Hoperius* and *Meladema* and phylogenetic implications for the tribe Colymbetini (Coleoptera Dytiscidae)

**Abstract** - New descriptions of the larvae of *Meladema lanio* (Fabricius), *M. coriacea* Laporte and *Hoperius planatus* Fall are provided. Characters from larval morphology are analyzed to infer the phylogenetic relationships of the genera *Meladema* Laporte and *Hoperius* Fall with other genera of the tribe Colymbetini (Colymbetinae). Larvae of *Meladema* are unique among other Colymbetini being characterized by the presence of a variable number of additional setae along the dorsal margin of both femora and tibiae. Larvae of *Hoperius* reveal to be remarkably modified and autapomorphic being characterized by a short antennomere II, the presence of a variable number of secondary setae on antennomeres I - II and maxillary palpomere, an elongate maxillary palpus, and a narrow and elongate mandible. A parsimony analysis based on 30 informative larval characters is carried out. Whereas the 12 most parsimonious trees support the placement of *Meladema* as sister to *Neoscutopterus* J. Balfour-Browne, the relative position of *Hoperius* remains unresolved within the Colymbetini. Larvae of *Meladema* share with those of *Neoscutopterus*: (i) the presence of additional setae both on the frontoclypeus and parietale, (ii) the presence of a large number of secondary setae on trochantera, (iii) the absence of spinulae along ventral margin of mesotibia and mesotarsus and (iv) the presence of additional setae both on abdominal segment VIII.

**Riassunto** - *Ridescrizione delle larve di Hoperius e Meladema e implicazioni filogenetiche per la tribù Colymbetini (Coleoptera Dytiscidae).*

Sono fornite nuove descrizioni delle larve di *Meladema lanio* (Fabricius), *M. coriacea* Laporte e *Hoperius planatus* Fall. I caratteri forniti dalla morfologia larvale sono analizzati per inferire le relazioni filogenetiche con gli altri generi della tribù Colymbetini (Colymbetinae). Le larve di *Meladema* sono uniche quelle degli altri Colymbetini essendo caratterizzate dalla presenza di un numero variabile di setole addizionali lungo il margine dorsale dei femori e delle tibie. Le larve di *Hoperius* si sono rilevate essere notevolmente modificate e autopomorfiche essendo caratterizzate dall'antennomero II più corto, dalla presenza di un numero variabile di setole secondarie sugli antennomeri I e II e sul palpomero mascellare, dal palpo mascellare più allungato e dalla mandibola più stretta e più allungata. È stata condotta un'analisi della parsimonia basata su 30 caratteri larvali informativi, mentre i 12 alberi più parsimoniosi supportano il posizionamento di *Meladema* come sister-group di *Neoscutopterus* J. Balfour-Browne, la posizione relativa di *Hoperius* nell'ambito dei Colymbetini rimane irrisolta. Le larve di *Meladema* e quelle di *Neoscutopterus* condividono: (i) la presenza di setole addizionali sul frontoclipeo e sul parietale, (ii) la presenza di un grande numero di setole secondarie sui trocanteri, (iii) l'assenza di spinule lungo il margine ventrale della mesotibia e del mesotarso e (iv) la presenza di setole addizionali sull'ottavo segmento addominale.

**Key words:** Coleoptera, Dytiscidae, Colymbetinae, larva, chaetotaxy, *Meladema lanio*, *M. coriacea*, *Hoperius planatus*, *Neoscutopterus*, *Rhantus*, *Colymbetes*, *Melanodytes*, phylogeny.

### INTRODUCTION

The Nearctic endemic *Hoperius* Fall, 1927 and the western Palaearctic endemic *Meladema* Laporte, 1835 are two small Colymbetinae genera (with one and three species



respectively) which include medium-sized diving beetles. Contrary to *Hoperius planatus* Fall, 1927, a typical woodland-pond inhabitant (Spangler, 1973), species of *Meladema* occur exclusively in permanent running waters, typically occupying deep pools in streams at intermediate altitudes (Ribera et al., 2003).

In term of classification, *Meladema* and *Hoperius* are presently included in the tribe Colymbetini (Colymbetinae) along with five other genera: *Bunites* Spangler, 1972, *Colymbetes* Clairville, 1806, *Melanodytes* Seidlitz, 1887, *Neoscutopterus* J. Balfour-Browne, 1943 and *Rhantus* Dejean, 1833 (Nilsson, 2001). Contrary to either of the cosmopolitan *Rhantus* or the holarctic *Colymbetes* which contains the majority of the species of the Colymbetini, every other genera in this tribe are small and confined to more restricted regions.

The monophyletic origin of the Colymbetini has been postulated recently on the basis of the sclerotized and transversely grooved pleurites of the second abdominal segment (first visible segment) of adults (homoplastic with Dytiscinae Dytiscini and Hyderodini) (Miller, 2001). It has also been suggested that the monobasic genus *Carabdytes* Balke, Hendrich & Wewalka, 1992 could represent the sister-group of the Colymbetini and that this clade could be sister to a clade comprised of Dytiscinae and Lancetinae (Miller, 2001). Such hypothesis, however, was hampered by the non-inclusion of many key taxa such as *Hoperius* and *Meladema*.

Assessment of larval morphology has proven useful in studying phylogenetic relationships among selected groups of the family Dytiscidae (e.g. Alarie et al., 2000, 2001, 2002a, 2002b). With regard to systematics of the Dytiscidae, the use of the positions and shapes of the setae and pores on larvae has proven useful for reconsidering classifications based mainly on adult characteristics. Larval description of *Meladema* (Bertrand, 1928, 1932a, 1932b; Falkenström, 1938; Nilsson & Hilsenhoff, 1991) and *Hoperius* (Spangler, 1973) has been provided in the past. Except for Nilsson & Hilsenhoff (1991), however, these descriptions are rather superficial and do not include detailed chaetotaxic analysis which hampers any comparisons in the context of recent works on larval Dytiscidae.

This paper is meant to be a step towards a better knowledge of the larval morphology of the genera of the tribe Colymbetini. It has the following goals: (i) description of the larvae of *Meladema lanio* (Fabricius, 1775), and re-descriptions of the larvae of *M. coriacea* Laporte, 1835, and *Hoperius planatus* with an emphasis on the chaetotaxic analysis of the head capsule, cephalic appendages, legs, last abdominal segment and urogomphi; (ii) identification of generic-level larval characters for these genera; and (iii) analysis of the phylogenetic position of *Meladema* and *Hoperius* within the Colymbetini based on larval features.

## MATERIAL AND METHODS

Description of the larval stages and taxonomic conclusions reported in this paper is based on examination of larvae collected in situations where they could be unequivocally associated with a particular species (*ex societate imaginis*). The exact locality from which the specimens were obtained is provided with the species description. The number of specimens studied (*n*) is indicated for each instar. Description of color is given for all species from ethanol-preserved specimens.



Larvae were disarticulated and mounted on standard glass slides with Hoyer's medium. Microscopic examination and measurements at magnification of 80-800X were done using an Olympus BX50 compound microscope equipped with Nomarsky differential interference optics. Figures were prepared through use of a drawing tube attached to the microscope. Voucher specimens of each species are deposited in the larval collection of the senior author (Department of Biology, Laurentian University, Canada).

## MEASUREMENTS

All measurements were made with a compound microscope equipped with a micrometer eyepiece. The part to be measured was adjusted so that it was, as nearly as possible, parallel to the plane of the objectives. The characters and terms used in the morphometric analysis are defined as follows:

Head length (HL): total head length including the frontoclypeus measured medially along the epicranial stem.

Head width (HW): maximum width measured posterior to the stemmata.

Length of frontoclypeus (FCL): from apex of the nasal to the back of the ecdysial suture.

Occipital foramen width (OcW): maximum width measured along the margin of the occipital foramen.

Length of antenna (AL): derived by adding the length of each individual antennomere; comparison among antennomeres was made using the capital letter A with a number corresponding to the article considered (e.g. A1 for antennomere 1); A3' is used as an abbreviation for the lateral elongation of antennomere 3.

Length of maxillary palpus (MXPL): derived by adding the length of each individual palpomere (e.g. MX1 for palpomere 1).

Length of galea (GalL): maximal length measured from apex of the galea to margin of the maxillary stipes (i.e., including the palpifer).

Length of stipes (StpL): maximal length of stipes measured along the outer margin.

Length of mandible (MndL): maximal length measured from apex to the mandibular condyla.

Width of mandible (MndW): maximal width measured across the proximal portion of the mandible.

Length of labial palpus (LBPL): derived by adding the length of each individual palpomere (e.g. LB1 for palpomere 1).

Length of legs: derived by adding the length of each individual article including the longest claw; the length of each article was taken at the longest point except for the trochanter which includes only the proximal portion (the length of distal portion being included in the femoral length).

Dorsal length of last abdominal segment (LLAS): includes the whole sclerite measured dorsally along the mid-line from the anterior margin to the posterior margin; siphon refers to the dorsal prolongation of the eighth abdominal segment (= last abdominal segment); the length of the siphon was determined by measuring the difference between the dorsal and ventral lengths of the segment.

Length of urogomphus (UROL): measured along the lateral margin.



### CHAETOTAXIC ANALYSIS

Primary (observed in first instar) and secondary (added throughout the ontogenetic development) setae and pores were distinguished on the cephalic capsule, head appendages, legs, last abdominal segment, and urogomphi. The setae and pores are coded according to the systems proposed by Alarie (1995) for the legs, the last abdominal segment, and urogomphi and Alarie (1998) for the cephalic capsule and head appendages. First instar larvae of the genus *Meladema* (and possibly *Hoperius*) are characterized by the presence of a variable number of additional setae on femora and tibiae which have been included in the count of secondary setae.

Setae are coded by two capital letters corresponding to the first two letters of the name of the structure on which the seta is located (AN, antenna; CO, coxa; FE, femur; MX, maxilla; LA, labium; TA, tarsus; TI, tibia; TR, trochanter) and a number. Pores are coded in a similar manner except that the number is replaced by a lower case letter. The position of the sensilla is described by adding the following abbreviations: A, anterior; AV, anteroventral; D, dorsal; Di, distal; Pr, proximal; PV, posteroventral; V, ventral.

### CLADISTIC ANALYSIS

Taxa were selected to give a broad overview of the morphological diversity found within the tribe Colymbetini. All known Colymbetini genera were included in the ingroup except the monobasic genus *Bunites* not described as larva yet. In order to examine the phylogenetic value of the characters observed on the larvae of *Meladema* and *Hoperius* and to test the relationship of these genera with the other genera of Colymbetini, a cladistic analysis was performed rooting the cladogram with selected genera of the subfamily Agabinae (*Agabus* Leach, 1817, *Ilybius* Erichson, 1832, *Ilybiosoma* Crotch, 1873, *Platambus* Thomson, 1859) as it has been suggested that Agabinae could represent the sister-group of the Colymbetinae (Miller, 2001). Moreover, three species of *Lancetes* Sharp, 1882 were included in the out-group as this genus was for a long time associated with the Colymbetinae. Although *Lancetes* was postulated to be more closely related to the Dytiscinae (Miller, 2001; Alarie et al., 2002a), a recent study suggested that it could be sister to the Colymbetini (Miller, 2003).

As many species had the same combination of character states, they were condensed to a single terminal to facilitate faster tree searches. *Meladema* and *Lancetes* were split into two monomorphic groups as the species studied were polymorphic for one and two characters respectively. The taxa examined for cladistic analysis are presented in Appendix 1.

The list of characters used (tab. 1) and the character state matrix (tab. 2) are reported. Apart from including the 30 informative characters we also have listed nine single autapomorphies (characters 6, 8, 9, 13, 14, 15, 17, 21, 33) (tab. 2). Although these features do not assist in the resolution of the relationships between taxa they still represent important facies by which terminal clades (i.e. genera) can be recognized. PAUP\* version 4.0b10 (Swofford, 2002) and MacClade 4 (Maddison & Maddison, 2000) software packages were used for parsimony searches, character editing, and cladogram examinations. The analyses included only the 30 informative characters. All characters were treated as



unordered (except character 32, ordered) and equally weighted. A heuristic search strategy was used to find minimum-length trees. Search was conducted with 100 random-addition replicates [tree bisection-reconnection (TBR)]. The data were bootstrapped with 1000 replicates to assess branch support. The consistency index (CI) (Kluge & Farris, 1969) and retention index (RI) (Farris, 1989) are given.

#### RE-DESCRIPTION OF LARVAE OF *MELADEMA* LAPORTE

**DIAGNOSIS.** First instar of *Meladema* can readily be distinguished from those of other genera of Colymbetini (*Bunites* not known) by: (i) the presence of additional setae on dorsal margin of femur (figs 20-21); (ii) a short and spine-like mesofemoral seta FE5 (fig. 21); (iii) the presence of additional setae both on ventral and dorsal margins of tibiae (figs 22-23); and, (iv) by a relatively larger size. In comparison to other genera of Colymbetini, third instar of *Meladema* are characterized by: (i) larger size (HL > 4.40 mm compared to < 3.50 mm in other Colymbetini); (ii) urogomphus more elongate (> 1.70 times LLAS compared to < 1.50 times, (iii) by a significantly larger number of secondary setae on legs (tab. 4), and (iv) by the presence of predominantly short and spine-like and elongate setae and hair-like secondary setae along outer and inner margin of urogomphus respectively (fig. 8).

#### LARVAE OF *MELADEMA LANIO* (FABRICIUS) (figs 1-2, 5, 8, 9-25)

**SOURCE OF MATERIAL.** Madeira, Ribeira da Ametade, 20.vii.2001; 30.xii.2003 Leg. S. Hughes.

**DESCRIPTION.** Third instar III ( $n = 3$ ) (figs 1-2, 5, 8). See also Falkenström (1938) for a dorsal habitus of third instar.

**Colour.** Head capsule predominantly dark brown; frontoclypeus with a faint 3-forked brownish pattern mesally; head appendages dark yellow to pale brown, palpomeres and antennomeres distinctly infusate apically; thoracic and abdominal terga predominantly dark brown; legs dark yellow to pale brown; urogomphus dark yellow to pale brown.

**Head** (figs 1-2). HL = 4.73-4.95 mm (mean = 4.86 mm); HW = 4.20-4.65 mm (mean = 4.65 mm); FCL = 1.58-2.03 mm (mean = 1.94 mm). Cephalic capsule subquadrate, as broad as long (HL/HW = 1.04-1.05), strongly constricted posteriorly, HW/OcW = not determined; ecdysial suture well-developed, coronal suture 0.59-0.62 times HL; occipital suture present; frontoclypeus strongly convex mesally, 0.38-0.41 times as long as HL, extending medially well beyond level of lateral lobes [= adnasalia]; apical margin of frontoclypeus with several club-shaped setae [lamellae clypeales of Bertrand (1972)] variable in size; ocularium present, six stemmata present laterally disposed along two vertical series of three stemmata each; tentorial pits visible ventrally on each side of middle at about mid-length. **Antenna.** AL = 2.65-2.71 mm (mean = 2.68 mm); four-segmented, shorter than HW; (AL/HW = 0.57-0.58);  $A2 > A1 = A3 > A4$ ,  $A2/A3 = 1.20-1.25$ ;  $A3'$  bulge-like;  $A3$  with a ventroapical spinula. **Mandible.** Falciform,  $MndL/MndW = 3.06-3.16$ ;  $MndL/HL = 0.46-0.51$ ; mandibular channel present, pubescence developed along inner margin. **Maxilla.** Stipes subrectangular, short and thick; cardo and galea present, lacinia lacking;  $StpL = 0.80-0.81$  mm (mean = 0.81 mm),  $StpL/MXPL = 0.42-0.43$ ;  $GaL = 0.32-0.34$  mm (mean = 0.33 mm), 0.42-0.46 times length of MX1;  $MXPL = 1.89-1.92$  mm (mean = 1.89 mm), 3-segmented;



AL/MXPL = 1.38-1.43; palpomere 1 = 2 > 3, length of palpomere 3/ length of palpomere 2 = 0.72-0.77. Labium. Prementum subrectangular, broader than long, slightly sinuate mesally; palpus 2-segmented; LBPL = 1.46-1.49 mm (mean = 1.47 mm); MXPL/LBPL = 1.29-1.31; LB2 0.52-0.58 as long as LB1. Chaetotaxy. Head capsule with several secondary setae, lateral margin of parietalia with about 21-23 spines; head appendages lacking secondary setae except mentum and mandible with several secondary setae.

Thorax. Pronotum subtrapezoidal dorsally, ovate laterally, widest at posterior margin, distinctly inflated anterolaterally; length of pronotum about twice that of mesonotum; metanotum subequal to mesonotum in length, both as broad as posterior margin of pronotum; pronotum with a posterotransverse carina; meso- and metanota both with antero- and posterotransverse carinae; maximum body width at level of meso- and metathorax; thoracic venter membranous; spiracular openings present anterolaterally on mesothorax.

Legs (fig. 5). Five-segmented; metathoracic legs longest, about 1.40 times length of prothoracic legs, and 2.80 times HW; meta[femur > coxa = tibia = tarsus > trochanter]; tarsus with two claws, posterior claw slightly shorter than anterior claw on pro- and mesothoracic legs, slightly longer on metathoracic leg; anterior metathoracic claw 0.18-0.25 times as long as metatarsus; spinulae present on ventral margin of protibia and protarsus only; tarsal claws with spinulae ventroproximally. Chaetotaxy. Position and number of secondary setae as shown in tab. 3.

Abdomen. Eight-segmented; LLAS = 3.43-3.73 mm (mean = 3.55 mm); dorsally sclerotized; segments 1-6 membranous ventrally, segments 7 and 8 completely sclerotized; terga 1 to 7 with antero- and posterodorsal transverse carina, tergum 8 with an anterodorsal transverse carina only; segments 1 to 7 with a pair of spiracular openings; segment 8 subcylindrical, LLAS/HW = 0.76-0.80, abruptly narrowing posterior to insertion of urogomphi; siphon 0.14-0.16 times as long as LLAS, slightly sinuated mesally. Chaetotaxy. Secondary setae predominantly short and spine-like.

Urogomphus (fig. 8). Not segmented, lacking a subbasal suture; total length of urogomphus = 5.90-6.40 mm (mean = 6.18 mm), 1.58-1.83 times as long as LLAS, and 1.27-1.33 times as long as HW. Chaetotaxy. Secondary setae predominantly short and spine-like and elongate and hair-like along outer and inner margin respectively.

#### DESCRIPTION, Second instar ( $n = 2$ ).

Colour. As for third instar, slightly paler.

Head. HL = 3.33-3.60 mm; HW = 3.25 mm; FCL = 1.50 mm. Cephalic capsule. HL/HW = 1.02-1.11, HW/OcW = 1.91-1.94; coronal suture 0.59-0.65 times HL; frontoclypeus 0.42-0.45 times as long as HL. Antenna. AL = 2.03-2.13 mm (mean = 2.08 mm); AL/HW = 0.63-0.66; A2 = A3 > A1 = A4, A2/A3 = 1.10-1.13. Mandible. MndL/MndW = 2.43-2.68; MndL/HL = 0.49-0.51. Maxilla. StpL = 0.49-0.53 mm (mean = 0.51 mm), StpL/MXPL = 0.36; Gall = 0.25 mm (mean = 0.25 mm), 0.50-0.53 times length of MX1; MXPL = 1.37-1.46 mm (mean = 1.41 mm); AL/MXPL = 1.46-1.49; palpomere 1 = 2 = 3, length of palpomere 3/length of palpomere 2 = 0.94. Labium. LBPL = 1.12-1.13 mm (mean = 1.12 mm); MXPL/LBPL = 1.22-1.29; LB2 0.74-0.75 as long as LB1. Chaetotaxy. Head capsule with several secondary setae, lateral margin of parietalia with about 17-20 secondary spines; head appendages lacking secondary setae except mandible and



mentum with several tiny secondary setae.

Thorax. Spiracular openings absent.

Legs. Metathoracic legs about 1.30 times length of prothoracic legs, and 2.80 times HW; meta[femur > coxa > tibia = tarsus > trochanter]; anterior metathoracic claw 0.28 as long as metatarsus; spinulae present on ventral margin of protibia and protarsus only; tarsal claws with spinulae ventroproximally. Chaetotaxy. Position and number of secondary setae as shown in tab. 3.

Abdomen. LLAS = 2.00-2.13 mm; spiracular openings absent; LLAS/HW = 0.62-0.65. Siphon 0.16 times as long as LLAS. Chaetotaxy. Secondary setae predominantly short and spine-like.

Urogomphus. Total length of urogomphus = 4.68-4.70 mm, 2.21-2.34 times as long as LLAS, and 1.44-1.45 times as long as HW. Chaetotaxy. Secondary setae predominantly short and spine-like and elongate and hair-like along outer and inner margin respectively.

DESCRIPTION, First instar ( $n = 2$ ) (figs 9-25).

Colour. As for second instar.

Head (figs 9-17). HL = 2.40-2.45 mm; HW = 2.25 mm; FCL = 1.08 mm. Cephalic capsule (figs 9-10). HL/HW = 1.07-1.09, HW/OcW = 1.92-2.09; coronal suture 0.55-0.56 times HL; frontoclypeus 0.44-0.45 times as long as HL. Antenna (figs 11-12). AL = 1.72 mm (mean = 1.72 mm); AL/HW = 0.76;  $A2 = A3 = A4 > A1$ ,  $A2/A3 = 1.02-1.04$ . Mandible (fig. 13) MndL/MndW = 2.87-3.22; MndL/HL = 0.52. Maxilla (figs 16-17). StpL = 0.36 mm (mean = 0.36 mm), StpL/MXPL = 0.31; GalL = 0.19-0.20 mm (mean = 0.20 mm), 0.56-0.59 times length of MX1; MXPL = 1.15-1.16 mm (mean = 1.15 mm); AL/MXPL = 1.48-1.50; palpomere 1 < 2 < 3, length of palpomere 3/length of palpomere 2 = 1.09-1.13. Labium (figs 14-15). LBPL = 0.90-0.92 mm (mean = 0.91 mm); MXPL/LBPL = 1.26-1.28; LB2 0.95-0.98 as long LB1. Chaetotaxy. All primary setae of generalized colymbetine larva present; frontoclypeus and parietale with several additional setae.

Thorax. Spiracular openings absent.

Legs (figs 18-23). Metathoracic legs about 1.30 times length of prothoracic legs, and 3.00 times HW; meta[femur > coxa > tibia = tarsus > trochanter]; anterior metathoracic claw 0.31 as long as metatarsus; spinulae present on ventral margin of protibia and protarsus only; tarsal claws with spinulae ventroproximally. Chaetotaxy. All primary setae and pores of generalized colymbetine larva present; primary seta TI6 elongate and hair-like. Trochanter, femur, tibia and tarsus with a variable number of additional setae (tab. 4).

Abdomen (fig. 24). LLAS = 1.15-1.23 mm; spiracular openings absent; LLAS/HW = 0.51-0.54. Siphon 0.22-0.25 times as long as LLAS. Chaetotaxy. All primary setae and pores of generalized colymbetine larva present; dorsal surface with a large number of additional spine-like setae.

Urogomphus (fig. 25). Total length of urogomphus = 3.25-3.35 mm, 2.74-2.83 times as long as LLAS, and 1.44-1.49 times as long as HW. Chaetotaxy. All primary setae and pores of generalized colymbetine larva present; inner and outer margin with a large number of additional either elongate and hair-like or spine-like setae respectively.

DISTRIBUTION. Endemic to Madeira (Ribera et al., 2003).



REMARKS. Mature larvae of *M. lanio* can readily be distinguished from those of *M. coriacea* by the relatively larger size ( $HL > 4.73$  mm compared to  $< 4.50$  mm), shorter antenna ( $< 1.40$  times length of maxillary palpus compared to  $> 1.50$ ), shorter urogomphi ( $< 1.30$  times HW compared to  $> 1.50$  times), and by the significantly larger number of secondary setae on legs (tab. 1). Nilsson and Hilsenhoff (1991) provided a succinct description of first instar of *M. coriacea*. In addition to its relatively larger size, first instar of *M. lanio* distinguished from those of the *M. coriacea* by the presence of additional setae on the trochanter and the relatively larger number of additional setae on femur, tibia and tarsus. Third instar of *M. lanio* was previously described by Falkenström (1938).

LARVAE OF *MELADEMA CORIACEA* LAPORTE (fig. 4; see also Falkenström (1938))

SOURCE OF MATERIAL. Gran Canaria, San Bartholemé de Tirajanae, 09.iii.1988, leg. M. Balke & L. Hendrich.

DESCRIPTION, Third instar ( $n = 4$ ).

Colour. Head capsule predominantly dark brown, frontoclypeus with a faint paler 3-forked brownish pattern mesally; parietals with a faint paler reticulate brownish mesally; head appendages dark yellow to pale brown, antennomeres and palpomeres slightly infusate apically; thoracic and abdominal terga predominantly dark brown, slightly paler along lateral margin; legs dark yellow to pale brown; urogomphus dark yellow to pale brown.

Head.  $HL = 4.40-4.50$  mm (mean = 4.46 mm);  $HW = 4.20-4.23$  mm (mean = 4.23 mm);  $FCL = 1.58-1.73$  mm (mean = 1.67 mm). Cephalic capsule subquadrate, as broad as long ( $HL/HW = 1.04-1.07$ ), strongly constricted posteriorly,  $HW/OcW = 1.65-1.76$ ; ecdysial suture well-developed, coronal suture 0.61-0.65 times HL; occipital suture present; frontoclypeus strongly convex mesally, 0.35-0.39 times as long as HL, extending medially well beyond level of lateral lobes [= adnasalia]; apical margin of frontoclypeus with several club-shaped setae [lamellae clypeales of Bertrand (1972)] variable in size; ocularium present, six stemmata present laterally disposed along two vertical series of three stemmata each; tentorial pits visible ventrally on each side of middle at about mid-length. Antenna.  $AL = 2.58-2.67$  mm (mean = 2.64 mm); four-segmented, shorter than HW; ( $AL/HW = 0.62-0.63$ );  $A1 = A2 > A3 > A4$ ,  $A2/A3 = 1.07-1.16$ ;  $A3'$  bulge-like;  $A3$  with a ventroapical spinula. Mandible. Falciform,  $MndL/MndW = 2.83-3.12$ ;  $MndL/HL = 0.47-0.50$ ; mandibular channel present, pubescence developed along inner margins. Maxilla. Stipes subrectangular, short and thick; cardo and galea present, lacinia lacking;  $StpL = 0.69-0.73$  mm (mean = 0.71 mm),  $StpL/MXPL = 0.39-0.43$ ;  $Gall = 0.31-0.32$  mm (mean = 0.31 mm), 0.40-0.49 times length of MX1;  $MXPL = 1.68-1.79$  mm (mean = 1.73 mm), 3-segmented;  $AL/MXPL = 1.47-1.59$ ; palpomere 1 = 2 > 3, length of palpomere 3/ length of palpomere 2 = 0.80-0.89. Labium. Prementum subrectangular, broader than long, slightly sinuate mesally; palpus 2-segmented;  $LBPL = 1.44-1.49$  mm (mean = 1.47 mm);  $MXPL/LBPL = 1.13-1.21$ ;  $LB2$  0.57-0.63 as long as  $LB1$ . Chaetotaxy. Head capsule with several secondary setae, lateral margin of parietal with about 12-13 secondary spines; head appendages lacking secondary setae except mentum and mandible with several secondary setae.



Thorax. Pronotum subtrapezoidal dorsally, ovate laterally, widest at posterior margin, distinctly inflated anterolaterally; length of pronotum about twice that of mesonotum; metanotum subequal to mesonotum in length, both as broad as pronotum; pronotum with a posterotransverse carena; meso- and metanota both with antero- and posterotransverse carenae; maximum body width at level of meso- and metathorax; thoracic venter membranous; spiracular openings present anterolaterally on mesothorax.

Legs. Five-segmented; metathoracic legs longest, about 1.40 times length of prothoracic legs, and 3.00 times HW; meta[femur > coxa = tibia = tarsus > trochanter]; tarsus with two claws, posterior claw slightly shorter than anterior claw on pro- and mesothoracic legs, slightly longer on metathoracic leg; anterior metathoracic claw 0.23-0.26 times as long as metatarsus; spinulae present on ventral margin of protibia and protarsus only; tarsal claws with spinulae ventroproximally. Chaetotaxy. Position and number of secondary setae as shown in tab. 3.

Abdomen. Eight-segmented; LLAS = 3.55-3.68 mm (mean = 3.61 mm); dorsally sclerotized; segments 1-6 membranous ventrally, segments 7 and 8 completely sclerotized; terga 1 to 7 with antero- and posterodorsal transverse carena, tergum 8 with an anterodorsal transverse carena only; segments 1 to 7 with a pair of spiracular openings; segment 8 subcylindrical, LLAS/HW = 0.84-0.88, abruptly narrowing posterior to insertion of urogomphi; siphon 0.14-0.19 times as long as LLAS, slightly sinuated mesally. Chaetotaxy. Secondary setae predominantly short and spine-like.

Urogomphus. One-segmented, lacking a subbasal suture; total length of urogomphus = 6.30-6.65 mm (mean = 6.49 mm), 1.76-1.85 times as long as LLAS, and 1.53-1.58 times as long as HW. Chaetotaxy. Secondary setae predominantly short and spine-like and elongate and hair-like along outer and inner margin respectively.

DISTRIBUTION. Widespread in the western Mediterranean and on the western Canaries (Ribera et al., 2003).

REMARKS. First instar of *M. coriacea* has been described by Nilsson & Hilsenhoff (1991). See also under *M. lanio*.

#### RE-DESCRIPTION OF LARVAE OF *HOPERIUS* FALL

DIAGNOSIS. Third instar of *Hoperius* can readily be distinguished from those of other genera of Colymbetini (larvae of *Bunites* not known) by: (i) A1 about twice as long as A2 (fig. 3) (compared to subequal or shorter); (ii) A1 and A2, and MX1 with several secondary setae (fig. 3); (iii) maxillary palpus about twice as long as length of labial palpus (compared to < 1.50 times); (iv) mandible elongate and narrow (fig. 4) (4.20 times as long as width compared to < 3.50 times as long as width); (v) a relatively shorter galea (0.30 times as long as MX1 compared to > 0.40 times); (vi) by a relatively shorter urogomphus (0.7 times as long as HW compared to subequal to longer (except *Melanodytes*) (fig. 7), and (vii) by the presence of elongate and hair-like secondary setae both along outer and inner margins of urogomphus (fig. 7).

Larvae of *Hoperius planatus* Fall (figs 3-4, 6-7, see also Spangler (1973))

SOURCE OF MATERIAL. U.S.A. Maryland, Talbot Co. 3 km SE Easton, Seth Forest, 38° 45' N., 76° 02' W, 05.v.1987, W. Steiner et al. coll.



RE-DESCRIPTION, Third instar ( $n = 1$ ). (figs 3-4, 6-7; Spangler (1973)).

Colour. Head capsule predominately dark brown laterally; frontoclypeus with a faint paler 3-forked brownish pattern mesally; parietalia with a faint reticulate brownish pattern mesally; head appendages dark yellow to pale brown, palpomeres and antennomeres slightly infusate apically; thoracic and abdominal terga predominantly dark brown; legs dark yellow to pale brown; urogomphus dark yellow to pale brown.

Head (figs 2, 4). HL = 3.13 mm; HW = 3.43 mm; FCL = 1.40 mm. Cephalic capsule subquadrate, as broad as long (HL/HW = 0.94), strongly constricted posteriorly, HW/OcW = 2.08; ecdysial suture well-developed, coronal suture 0.55 times HL; occipital suture present; frontoclypeus strongly convex mesally, 0.45 times as long as HL, extending medially beyond level of lateral lobes [= adnasalia]; apical margin of frontoclypeus with several club-shaped setae [lamellae clypeales of Bertrand (1972)] variable in size; ocularium present, six stemmata present laterally disposed along two vertical series of three stemmata each; tentorial pits visible ventrally on each side of middle at about midlength. Antenna (fig. 2). AL = 1.63 mm; four-segmented, shorter than HW; (AL/HW = 0.48);  $A1 > A2 = A3 > A4$ ,  $A2/A3 = 0.94$ ;  $A3$ ' pore-like;  $A3$  with a ventroapical spinula. Mandible (fig. 4) falciform, MndL/MndW = 4.16; MndL/HL = 0.67; mandibular channel present, lacking pubescence along inner margins. Maxilla. Stipes subrectangular, short and thick; cardo and galea present, lacinia lacking; StpL = 0.53 mm, StpL/MXPL = 0.32; GalL = 0.16 mm, 0.28 times length of MX1; MXPL = 1.66 mm, 3-segmented; AL/MXPL = 0.98; palpomere 1 = 2 = 3, length of palpomere 3/length of palpomere 2 = 0.93. Labium. Prementum subrectangular, broader than long, slightly sinuate mesally; palpus 2-segmented; LBPL = 0.87 mm; MXPL/LBPL = 1.92; LB2 0.80 as long as LB1. Chaetotaxy. Head capsule with several secondary setae, lateral margin of parietalia with about 9-11 spines; secondary setae present on mandible,  $A1$  and  $A2$ , and MX1.

Thorax. Pronotum trapezoidal dorsally, ovate laterally, widest at posterior margin; length of pronotum about twice that of mesonotum; metanotum subequal to mesonotum in length, both as broad as pronotum; pronotum with a posterotransverse carena; meso- and metanota both with antero- and posterotransverse carenae; maximum body width at level of meso- and metathorax; thoracic venter membranous; spiracular openings present anterolaterally on mesothorax.

Legs (fig. 6). Five-segmented; metathoracic legs longest, about 1.30 times length of prothoracic legs, and 2.50 times HW; meta[femur > coxa > tibia = tarsus > trochanter]; tarsus with two claws, posterior claw slightly shorter than anterior claw on pro- and mesothoracic legs, slightly longer on metathoracic leg; anterior metathoracic claw 0.28 times as long as metatarsus; spinulae present on ventral margin of profemur, tibiae and tarsi; tarsal claws with spinulae ventroproximally. Chaetotaxy. Position and number of secondary setae as shown in tab. 3.

Abdomen. Eight-segmented; LLAS = 3.08 mm; dorsally sclerotized; segments 1-6 membranous ventrally, segments 7 and 8 completely sclerotized; terga 1 to 7 with antero- and posterodorsal transverse carina, tergum 8 with an anterodorsal transverse carina only; segments 1 to 7 with a pair of spiracular openings; segment 8 subcylindrical, LLAS/HW = 0.90, abruptly narrowing posterior to insertion of urogomphi; siphon 0.16 times as long



as LLAS, slightly indented apically Chaetotaxy. Secondary setae either short and spine-like or elongate and hair-like.

Urogomphus (fig. 7). One-segmented, lacking a subbasal suture; total length of urogomphus = 2.33 mm, 0.76 times as long as LLAS, and 0.68 times as long as HW. Chaetotaxy. Secondary setae elongate and hair-like both along outer and inner margins.

DESCRIPTION, Second instar ( $n = 1$ ).

Colour. As for third instar, slightly paler:

Head. HL = 2.18 mm; HW = 2.40 mm; FCL = 1.05 mm. Cephalic capsule. HL/HW = 0.91, HW/OcW = 2.50; coronal suture 0.52 times HL; frontoclypeus 0.48 times as long as HL. Antenna. AL = 1.62 mm; AL/HW = 0.68;  $A1 > A4 > A2 = A3$ ,  $A2/A3 = 0.87$ . Mandible. MndL/MndW = 3.73; MndL/HL = 0.71. Maxilla. StpL = 0.43 mm, StpL/MXPL = 0.33; GalL = 0.18 mm, 0.45 times length of MX1; MXPL = 1.30 mm; AL/MXPL = 1.25; palpomere  $1 < 2 < 3$ , length of palpomere 3/length of palpomere 2 = 1.07. Labium. LBPL = 0.61 mm; MXPL/LBPL = 2.11; LB2 1.10 as long as LB1. Chaetotaxy. Head capsule with several secondary setae, lateral margin of parietalia with about 9-11 secondary spines; head appendages lacking secondary setae except mandible and mentum with several tiny secondary setae.

Thorax. Spiracular openings absent.

Legs. Metathoracic legs about 1.30 times length of prothoracic legs, and 2.50 times HW; meta[femur = coxa > tibia = tarsus > trochanter; anterior metathoracic claw 0.31 as long as metatarsus; spinulae present on ventral margin of femora, tibiae and tarsi; tarsal claws with spinulae ventroproximally. Chaetotaxy. Position and number of secondary setae as shown in tab. 3.

Abdomen. LLAS = 2.05 mm; spiracular openings absent; LLAS/HW = 0.85. Siphon 0.17 times as long as LLAS. Chaetotaxy. Secondary setae predominantly short and spine-like, hair-like and elongate along lateral margin.

Urogomphus. Total length of urogomphus = 1.80 mm, 0.88 times as long as LLAS, and 0.85 times as long as HW. Chaetotaxy. Secondary setae hair-like and elongate along both outer and inner margins.

DISTRIBUTION. *Hoperius planatus* is confined to southeastern United States (Spangler, 1973).

REMARKS. Third instar of *H. planatus* was described by Spangler (1973).

## RESULTS

Heuristic search with random-addition sequence replicates found minimal length topologies of 40 steps from the data matrix presented in this study (tab. 2). TBR swapping of minimal-length trees from 100 random-addition replicates led to 12 trees (CI = 0.83; RI = 0.93) all of which incorporating *Meladema* as sister to *Neoscutopterus*. In most of the most parsimonious trees (10/12) *Hoperius* stands as sister-group of other Colymbetini genera either independently (6/10) or as a clade including *Melanodytes* (4/10).

## DISCUSSION

Larvae of *Meladema* and *Hoperius* were re-described and documented in detail in this contribution and both these genera have turned out to be characterized by several unique



larval character states within the Colymbetini (fig. 26). Larvae of *Hoperius planatus* are characterized by: (i) a shorter A2 (character 06, fig. 3); (ii) the presence of a variable number of secondary setae on A1 (character 08, fig. 3), A2 (character 09, fig. 3), and MX1 (character 14); (iii) a more elongate maxillary palpus (character 13); (iv) a more elongate and narrower mandible (character 16, fig. 4, homoplastic with *Neoscutopterus*); (v) shorter urogomphi (character 35, fig. 7, homoplastic in *Melanodytes*). Larvae of *Meladema* for their part are unique among other Colymbetini being characterized by the presence of a variable number of additional setae along the dorsal margin of both femora (character 23, figs 20-21) and tibiae (character 26.2, figs 22-23). It is noteworthy that first instar of *M. lanio* is characterized by the presence of additional setae on the trochanter (character 21, figs 18-19), a unique feature among the Dytiscidae.

Based on this study, the monophyly of the Colymbetini is indicated by at least five unambiguous synapomorphies (i.e. found only in the group and unreversed) (fig. 26). Larvae of the Colymbetini have evolved (i) a relatively more distal articulation of the primary pore ANg on A4 (character 07, fig. 11), (ii) a much reduced sensorial appendage (A3', figs 1, 3, 11, 12) on A3 (character 10), (iii) a more distal position of the procoxal setae CO7 (character 19, fig. 18), (iv) the presence of marginal spinulae at least on the protarsal claws (character 30, figs 22-23), and (v) the presence of natatory setae on femora, tibia and tarsi (character 32.2).

First instar of Colymbetini minus *Hoperius* were found to be characterized by (i) the presence of a large number of lamellae clypeales (character 03, fig. 9), (ii) the presence of an occipital carina (character 5, fig. 9), (iii) the proximal articulation of the primary seta FE1 on femora (character 22, fig. 20) and (iv) the elongate and hair-like aspect of the primary seta TI6 on tibiae (character 27, fig. 23). The short and spine-like condition of the primary seta TI6 (character 27, fig. 23) is seen as a reversal from the derived condition. Presence of any of these character states in either *Hoperius planatus* or *Bunites distigma* (Brullé, 1838) (unknown as first instar) would likely provide stronger evidence in support of a monophyletic origin of the Colymbetini.

A monophyletic origin of *Rhantus* (*sensu lato*) + *Neoscutopterus* + *Meladema* is indicated by the unique presence of additional setae along the ventral margin of tarsi (character 29, figs 22-23) and to a lesser extent by the presence of an elongate and hair-like femoral setae FE5 (character 24). The spine-like condition of the primary seta FE5 in *Meladema lanio* (character 24, fig. 21) is deemed to represent a reversal from the derived condition. These features allied to the unique configuration of the ovipositor of *Rhantus* and *Meladema* (Burmeister, 1976; *Neoscutopterus* not studied) indicate that this clade is very distinctive within the Colymbetini. It is worth mentioning that the genus *Rhantus* (*sensu lato*) stands out as not monophyletic in our study in agreement with a recent study based on adult morphology (Miller, 2001). However, increased larval taxon sampling is required before refinement of the classification of this clade.

A placement of *Meladema* as sister to *Neoscutopterus* seems rather clear based on larval morphology. Bootstrap value (0.84) (fig. 27) indicates strong support for the monophyly of members of these genera with respect of the chosen out-group. Larvae of *Meladema* share with those of *Neoscutopterus*: (i) the presence of additional setae on the frontoclypeus (character 01, fig. 9) and parietale (character 04, fig. 9), (ii) the presence of a large num-



ber of secondary setae on trochantera (character 20, fig. 5), (iii) the absence of spinulae along ventral margin of mesotibia and mesotarsus (character 31) and (iv) the presence of additional setae on abdominal segment 8 (character 34, fig. 24).

Whereas inclusion of *Meladema* among the Colymbetini seems rather clear based on larval morphology, the relationship of *Hoperius* with other other Colymbetini genera remains equivocal (fig. 27). As stated above, the larvae of *Hoperius* are remarkably modified and autapomorphic within the Colymbetini. The topology proposed in most of the most parsimonious trees (10/12) would support a more basal position of *Hoperius* within the Colymbetini. In absence of first instar of *Hoperius*, however, such hypothesis cannot be seen as strongly supported knowing that the hypothesis of monophyletic origin of the Colymbetini minus *Hoperius* provided in this paper is founded on first instar larval characters only.

#### ACKNOWLEDGEMENTS

We are grateful to Lars Hendrich and Paul J. Spangler who provided the larvae of *Meladema coriacea* and *Hoperius planatus* respectively. Thanks also to Anders N. Nilsson and two other anonymous reviewers for their constructive and insightful comments on a previous version of this paper. Financial support was provided by the Natural Sciences and Engineering Research Council of Canada in the form of an individual operating research grant to Y. Alarie.

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Table 1. Characters used for the phylogenetic analysis and the coding of states using selected genera of Agabinae as outgroup; 0 indicates plesiomorphic state and number > 0 indicates progressively more apomorphic states.

Character		States
Head capsule		
01	Frontoclypeus (first instar)	0 - lacking additional setae 1 - with additional setae
02	Pore FRe	0 - lacking 1 - present
03	Lamellae clypeales (first instar)	0 - < 17 1 - > 20
04	Parietale (first instar)	0 - lacking additional setae 1 - with additional setae
05	Occipital carina (first instar)	0 - lacking 1 - present
Head appendages		
06	Antennomere 1 (first instar)	0 - subequal to longer than A2 1 - about 0.50 times length of A2
07	Antennomere I, pore ANg (first instar)	0 - proximal 1 - median
08	Antennomere I (third instar)	0 -lacking secondary setae 1 - with secondary setae
09	Antennomere II (third instar)	0 - lacking secondary setae 1 - with secondary setae
10	Antennomere III, lateral projection (A3')	0 - bulge- to finger-like 1 - pore-like
11	Antennomere III, ventroapical spinula	0 - present 1 - absent
12	Antennomere III, additional ventroapical pores (first instar)	0 - absent 1 - present
13	Maxillary palpus (third instar)	0 - less than 1.50 times length of labial palpus 1 - about 2.00 times length of labial palpus
14	Maxillary palpomere I (third instar)	0 - lacking secondary setae 1 - with secondary setae
15	Mandible, additional setae (first instar)	0 - absent 1 -present
16	Mandible (third instar)	0 - less than 3.00 times as long as broad 1 - more than 3.50 times as long as broad
17	Anterior margin of prementum	0 - straight or slightly sinuate 1 - deeply sinuate
18	Head appendages (excluding mandible) (third instar)	0 - articles not secondarily subdivided proximally 1 - some articles secondarily subdivided proximally
Legs		
19	Procoxal seta CO7	0 - inserted proximally 1 - inserted distally
20	Metatrochanter, (third Instar)	0 - with < 8 secondary setae 1 - with > 16 secondary setae
21	Trochanter (first instar)	0 - lacking additional setae 1 - with additional setae
22	Seta FE1 (first instar)	0 - inserted proximally 1 - inserted distally



Character		States
23	Femur (first instar)	0 - additional setae on dorsal margin absent 1 - additional setae on dorsal margin present
24	Seta FE5 (first instar)	0 - short and spine-like 1 - elongate and hair-like
25	Seta FE6 (first instar)	0 - short 1 - elongate
26	Tibia (first instar)	0 - additional setae absent 1 - additional setae on ventral margin 2 - additional setae on dorsal and ventral margins
27	Seta TI6 (first instar)	0 - short and spine-like 1 - elongate and hair-like
28	Seta TI7 (first instar)	0 - short and spine-like 1 - elongate and hair-like
29	Tarsus (first instar)	0 - additional setae absent 1 - additional setae present
30	Protarsal claws (first instar)	0 - marginal spinulae absent 1 - marginal spinulae present
31	Mesotibial and mesotarsal marginal spinulae (third instar)	0 - strongly developed 1 - weakly developed or lacking
32	Legs, natatory setae (first and second instar)	0 - lacking 1 - on tibiae and tarsi 2 - on femora, tibiae, and tarsi
Abdomen		
33	Abdominal segment 7 (first instar)	0 - membranous ventrally 1 - sclerotized ventrally
34	Abdominal segment 8	0 - additional setae absent 1 - additional setae present
35	Urogomphus (third instar)	Urogomphus 0 - 0.90-1.50 times HW 1 - short < 0.70 times HW 2 - > 2.50 times HW
36	Urogomphomere 1 (second and third instar)	0 - lacking secondary setae 1 - with secondary setae
37	Urogomphus (first instar)	0 - not fractured 1 - fractured
38	Urogomphus	0 - two-segmented 1 - one segmented
39	Additional urogomphal setae (first instar)	0 - absent 1 - present



Table 2. Matrix of 39 morphological characters of larvae of selected genera of the family Dytiscidae. The 39 columns correspond to the character number (tab. 1); state 0 is the state observed in the outgroup; ? = missing data.

Taxon	Characters							
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-39
<i>Agabus</i>	00000	00000	00000	00000	00000	00000	00000	0000
<i>Ilybius</i>	00000	00000	00000	00000	00000	00000	00000	0000
<i>Ilybiosoma</i>	00000	00000	00000	00000	00000	00000	00000	0000
<i>Platambus</i>	00000	00000	00000	00000	00000	00000	00000	0010
<i>Lancetes I</i>	01000	00000	11000	00100	00101	10100	01002	1111
<i>Lancetes II</i>	01000	00000	11000	00100	00001	10100	01002	1110
<i>Colymbetes</i>	01101	01001	11000	00010	01001	01101	02000	1010
<i>Rhantus (Rhantus)</i>	01101	01001	11000	00010	01011	11111	02000	1010
<i>Rhantus (Nartus)</i>	01101	01001	11000	0001?	01011	11111	0200?	1010
<i>Melanodytes</i>	01101	0?001	??00?	00010	010?1	01101	?2001	1010
<i>Neoscutopterus</i>	11111	01001	11001	11011	01011	11111	12110	1011
<i>Hoperius</i>	?1???	11111	1111?	10010	?????	?01?1	02??1	101?
<i>Meladema coriacea</i>	11111	01001	11000	00011	01111	2?111	12010	1011
<i>Meladema lanio</i>	11111	01001	11000	00011	11101	20111	12010	1011



Table 3. Number of secondary setae<sup>1</sup> on the legs of second and third instar of *Hoperius planatus* (Hplan), *Meladema lanio* (Mlani), and *M. coriacea* (Mcori). Abbreviations: A = anterior; AD = anterodorsal; AV = anteroventral; CO = coxa; D = dorsal; Di; distal; FE = femur; n = number of specimens studied; NS = natatory setae PD = posterodorsal; Pr = proximal; PV = posteroventral; range = total number of secondary setae on segment; TA = tarsus; TI = tibia; TR = trochanter; V = ventral.

Segment	Sensillar series	Second Instar		Third Instar		
		Hplan (n = 2)*	Mlani (n = 2)	Hplan (n = 2)*	Mlani (n = 3)	Mcori (n = 4)
ProCO	D	8	22-23	13-14	41-50	29-30
	A	7-8	14-20	19	28-40	15-18
	V	5-6	18-19	5	20-27	12-20
	Total	21	56-60	38	90-116	57-66
ProTR	Pr	1-3	9-11	3	13-20	5-7
	Di	1	20-22	1-2	18-28	6-12
	Total	2-4	29-33	4-5	31-48	11-19
ProFE	NS(PD)	19	34-35	40-41	43-59	52-59
	AD	15-16	38-42	27-30	48-50	24-39
	AV	19-20	32-34	38	33-44	25-35
	PD	0-1	4-10	0-1	17-24	3-14
	PV	13-14	17-26	26-27	21-28	17-26
	Total	67-69	132-140	131-137	170-189	136-149
ProTI	NS(PD)	19-20	37-38	36	48-59	50-53
	AD	4-7	19-21	11-12	21-25	12-15
	AV	12-13	14	9	14-20	9-12
	PD	0	4-9	0	8-12	2-5
	PV	6-7	7-14	6	7-13	7-11
	Total	43-45	87-90	62-63	110-116	84-93
ProTA	NS(PD)	16	22-23	19-21	26-30	25-33
	AD	3	12-17	4	18-20	10-12
	AV	8	11-13	9-10	17-23	9-12
	PD	0	7-10	0	8-11	3-4
	PV	4-6	9-11	6	9-14	7-9
	Total	31-33	62-73	39-40	82-94	57-68
MesoCO	D	7	19-25	16-17	32-46	25-30
	A	6-9	19-20	11-12	34-37	20-22
	V	7	19-30	8	21-26	11-21
	Total	20-23	57-75	35-37	92-104	56-70
MesoTR	Pr	2	13-16	3-4	15-21	7-10
	Di	1-2	19-22	1-2	27-30	12-14
	Total	3-4	32-38	4-6	45-48	21-22
MesoFE	NS(PD)	15-18	34-35	33-37	54-63	50-61
	AD	21-23	50	29-30	64	32-43
	AV	18-21	31-32	33-40	42-47	29-32
	PD	0	5-6	0	11-15	9-12
	PV	12-14	24-27	29-35	30-34	20-26
	Total	68-74	145-149	131-135	206-215	152-160



Segment	Sensillar series	Second Instar		Third Instar		
		Hplan ( <i>n</i> = 2)*	Mlani ( <i>n</i> = 2)	Hplan ( <i>n</i> = 2)*	Mlani ( <i>n</i> = 3)	Mcori ( <i>n</i> = 4)
MesoTI	NS(PD)	22-23	44-46	40-43	69-80	61-69
	AD	7-11	28-31	12-15	40-64	17-23
	AV	14-19	24	14-15	22-44	17-19
	PD	0	6-8	0	12-15	6-8
	PV	8	13-14	8-9	10-32	8-11
	Total	52-56	116-122	75-81	161-232	114-126
MesoTA	NS(PD)	18	32-35	31	39-45	40-49
	AD	4-5	23-24	4-5	24-30	13-14
	AV	11-13	17	10-12	15-25	11-15
	PD	0	10	0	8-11	3-4
	PV	5-6	10-12	6-7	9-15	6-10
	Total	39-41	94-96	53-54	101-106	78-92
MetaCO	D	4-5	17-18	9-12	27-34	20-27
	A	7-8	19-22	10-11	35-52	15-28
	V	7	15-18	7-8	17-21	10-19
	Total	18-20	54-55	27-30	85-105	46-63
MetaTR	Pr	2	16-18	2-3	18-22	6-8
	Di	1-2	21	1-2	28-34	12-16
	Total	3-4	37-39	4	46-56	20-24
MetaFE	NS(PD)	7-8	28-30	12-16	44-50	43-56
	AD	16-20	55	27-32	72-78	33-48
	AV	18-22	33-35	30-32	44-56	27-31
	PD	0	8-10	0-2	9-12	3-8
	PV	10	22-23	26-29	33-39	23-30
	Total	55-56	149-150	100-104	213-227	137-158
MetaTI	NS(PD)	23-24	41-43	40-44	74-86	68-78
	AD	15-16	31-36	18	42-45	24-30
	AV	16-17	24-27	15-16	20-31	17-24
	PD	0	9	0	7-10	1-8
	PV	8	10	10	12-16	9-14
	Total	63-64	118-122	84-87	169-175	120-148
MetaTA	NS(PD)	23-24	36	35-36	54-56	44-56
	AD	6	24-27	5-7	30-37	16-20
	AV	13-14	13-20	13	16-22	13-16
	PD	13-14	4	0	7-8	0-3
	PV	5-6	12-16	5	15-16	7-10
	Total	48-49	96	58-61	122-139	87-102

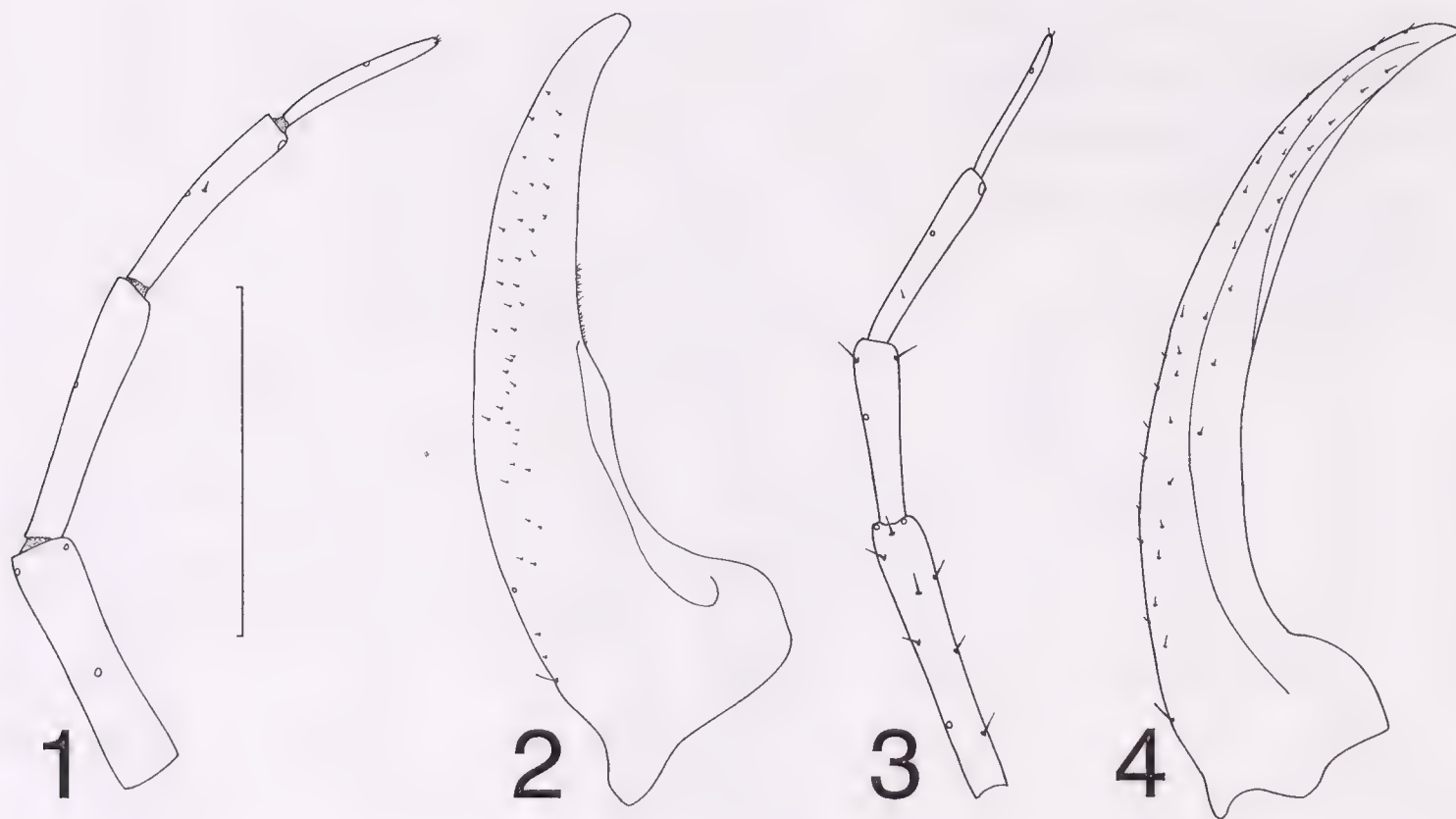
<sup>1</sup> Total number of secondary setae include additional setae (cf. Material and Methods); \* both legs of one specimen were used.



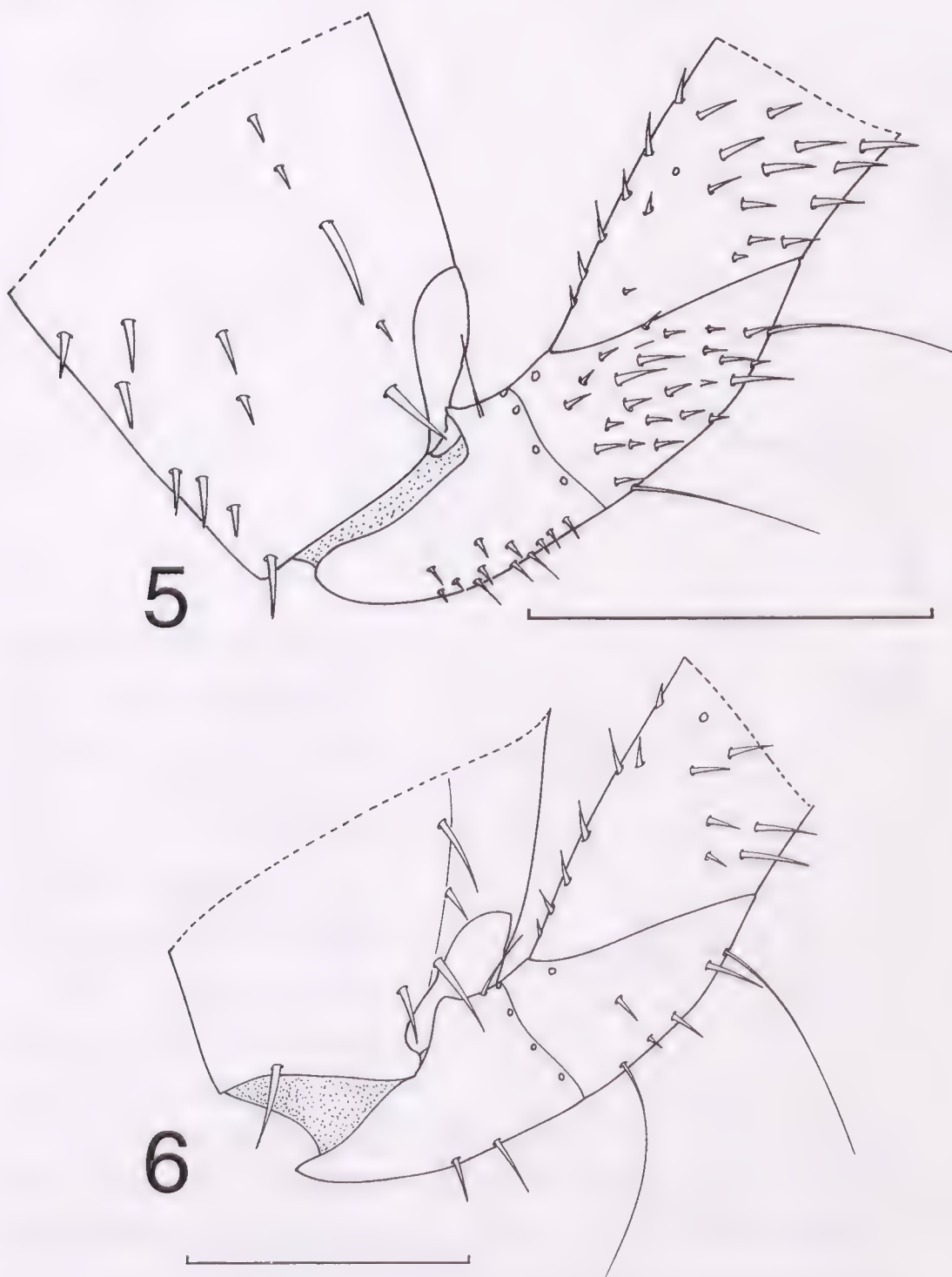
Table 4. Number and position of additional setae on the legs of first instar of *Meladema lanio* (two specimens studied). Abbreviations: ADi = anterodistal; AV = anteroventral; D = dorsal; FE = femur; PDi = posterodistal; PV = posteroventral; TA = tarsus; TI = tibia; TR = trochanter.

Segment	Position		Segment	Position	
ProTR	ADi	0-1	ProTI	AD	4
	PDi	0-1		AV	4
MesoTR	ADi	1-2		PD	0
	PDi	0-1	MesoTI	PV	4
MetaTR	ADi	1-2		AD	5
	PDi	0		AV	6
ProFE	AD	8-9		PD	0-1
	AV	11-13		PV	4-5
	PD	1-2	MetaTI	AD	5
	PV	6		AV	7
MesoFE	AD	8		PD	1-2
	AV	13-14		PV	6
	PV	1	ProTA	AV	6
	PV	6-8		PV	3
MetaFE	AD	8-9	MesoTA	AV	7
	AV	12-13		PV	4-5
	PD	2	MetaTA	AV	6-7
	PV	7-10		PV	4-5





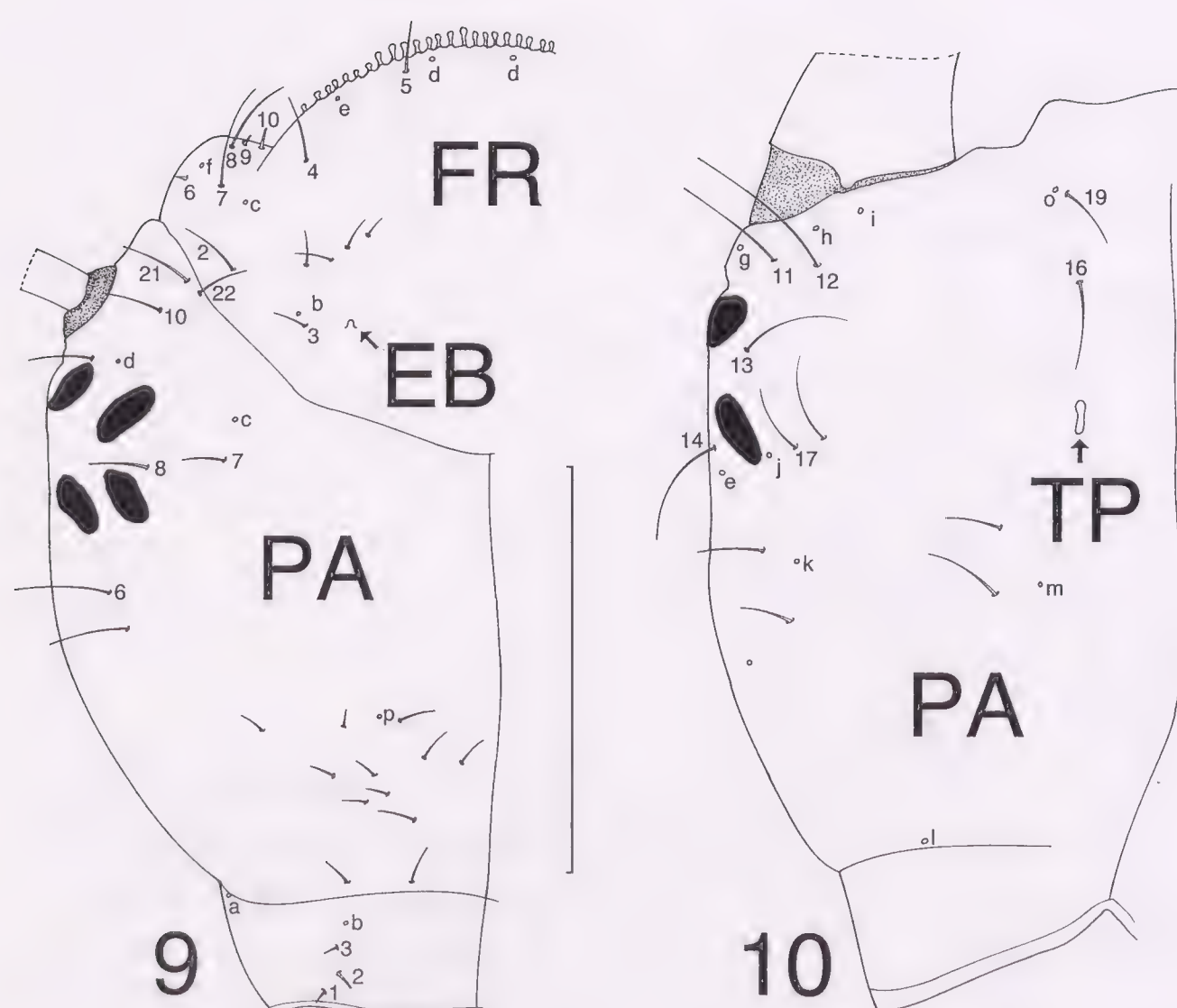
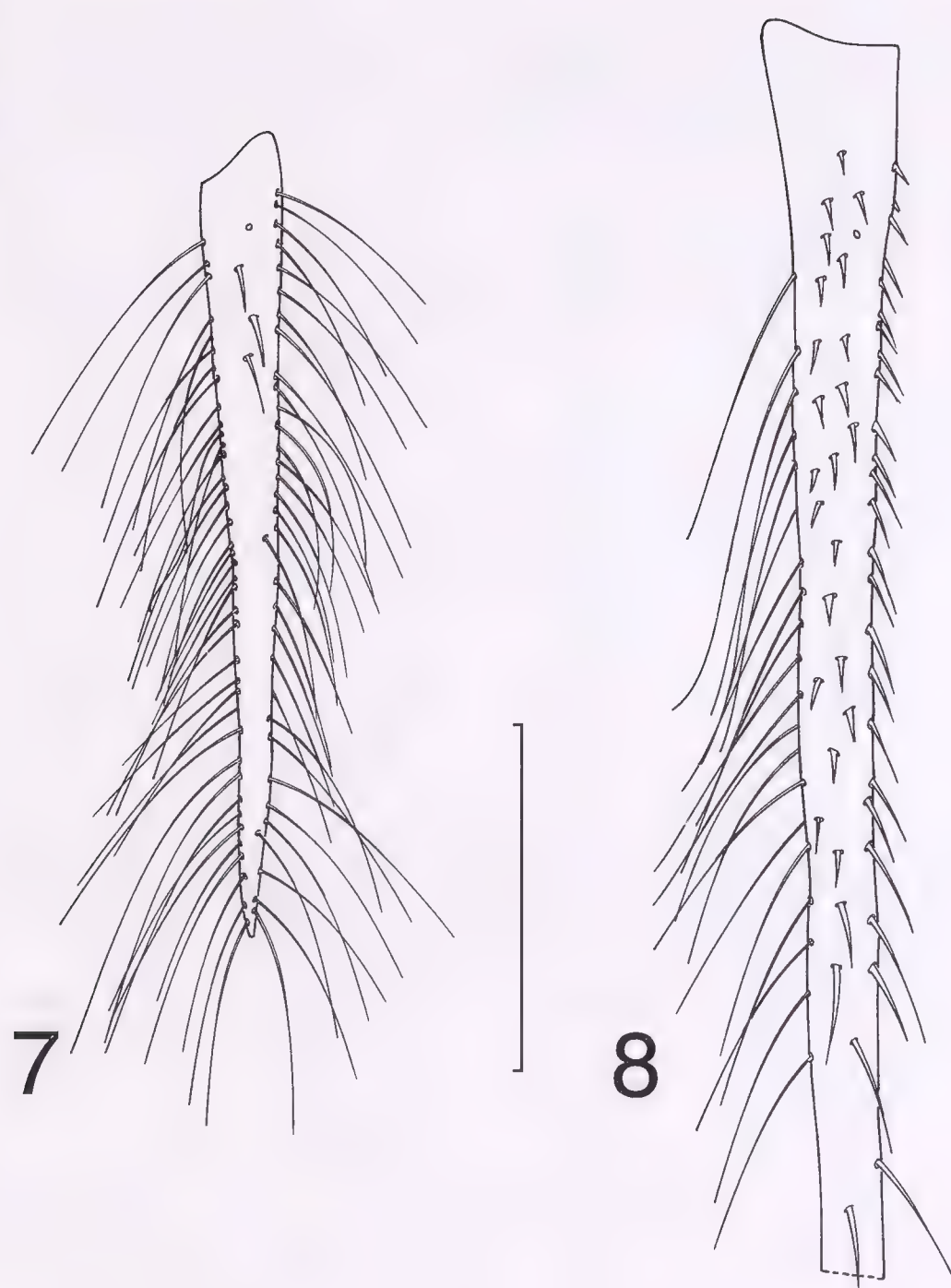
Figs 1-4. Dorsal surface of antenna and mandible of selected species of Colymbetini, third instar: 1 - antenna of *Meladema lanio*; 2 - mandible of *M. lanio*; 3 - antenna of *Hoperius planatus*; 4 - mandible of *H. planatus*. Scale bar = 1.00 mm.



Figs 5-6. Anterior surface of trochanter of selected species of Colymbetini, third instar: 5 - *Meladema lanio*, scale bar = 1.00 mm; 6 - *Hoperius planatus*, scale bar = 0.50 mm.

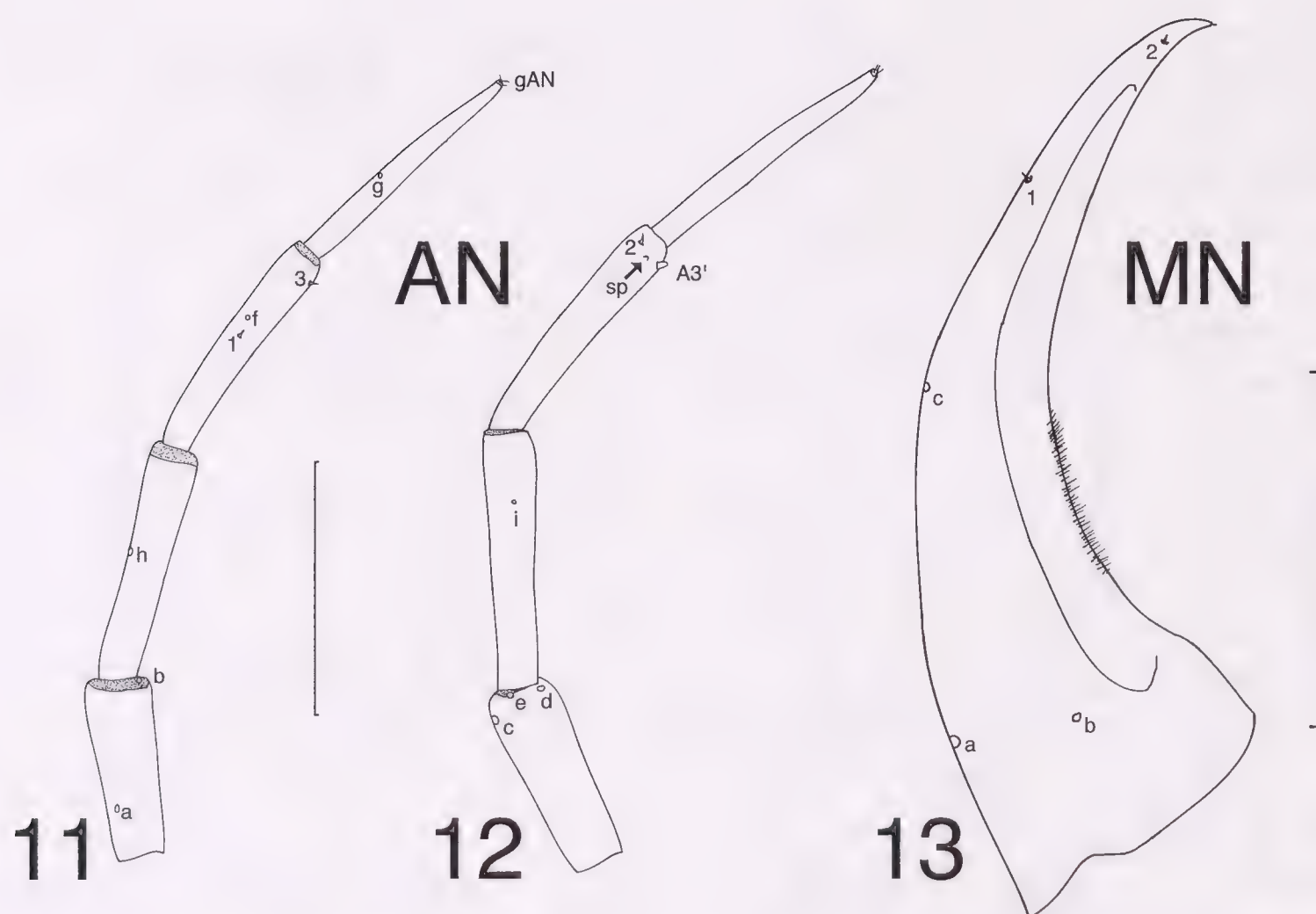


Figs 7-8. Urogomphus of selected species of Colymbetini, dorsal aspect, third instar: 7 - *Hoperius planatus*; 8 - *Meladema lanio*, proximal portion. Scale bar = 1.00 mm.

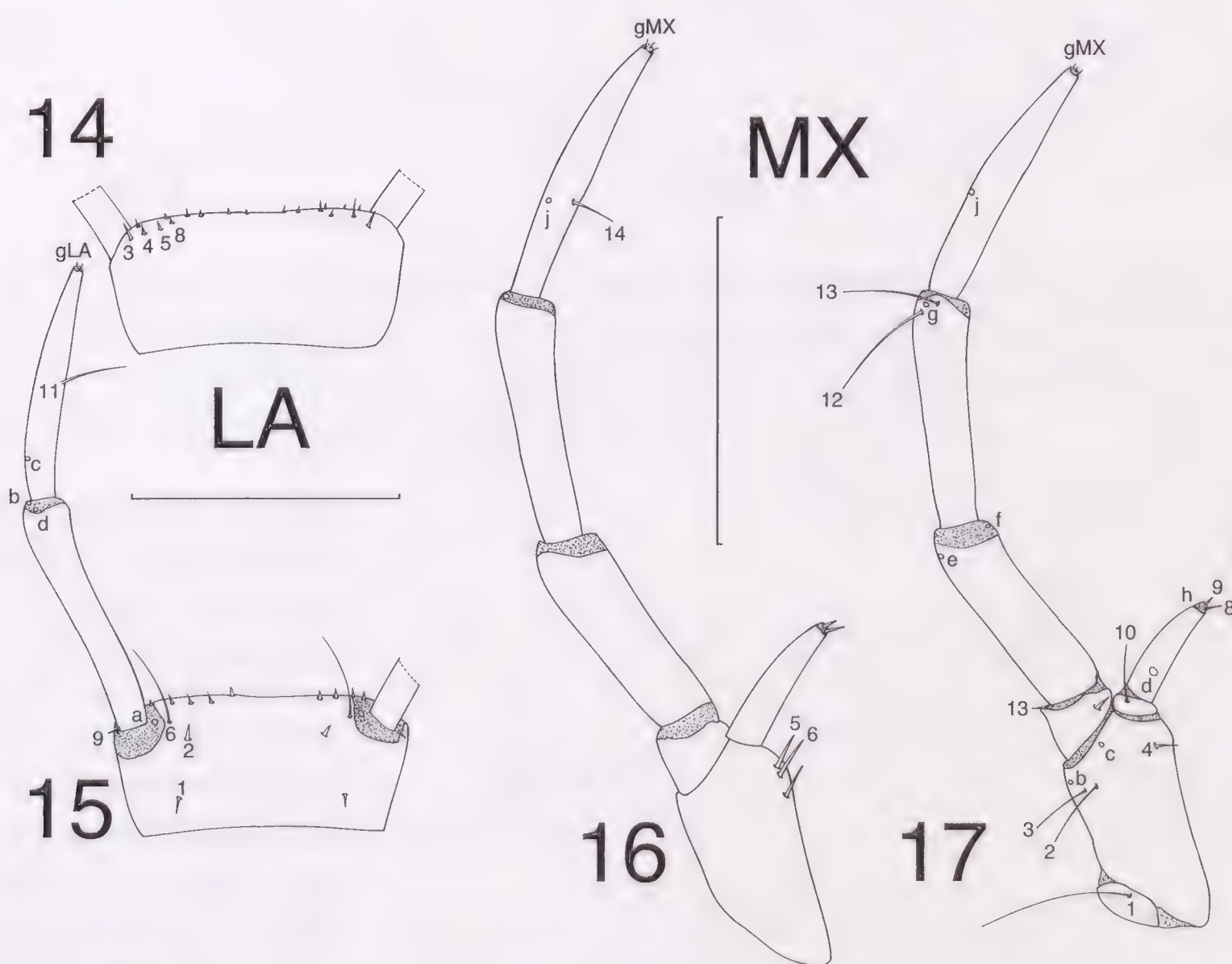


Figs 9-10. Head capsule of *Meladema lanio*, first instar: 9 - dorsal aspect (color pattern not represented); 10 - ventral aspect. Abbreviations: EB = egg bursters; FR = frontoclypeus; PA = parietale; TP = tentorial pits, numbers and lowercase letters refer to primary setae and pores, respectively. Scale bar = 1.00 mm.





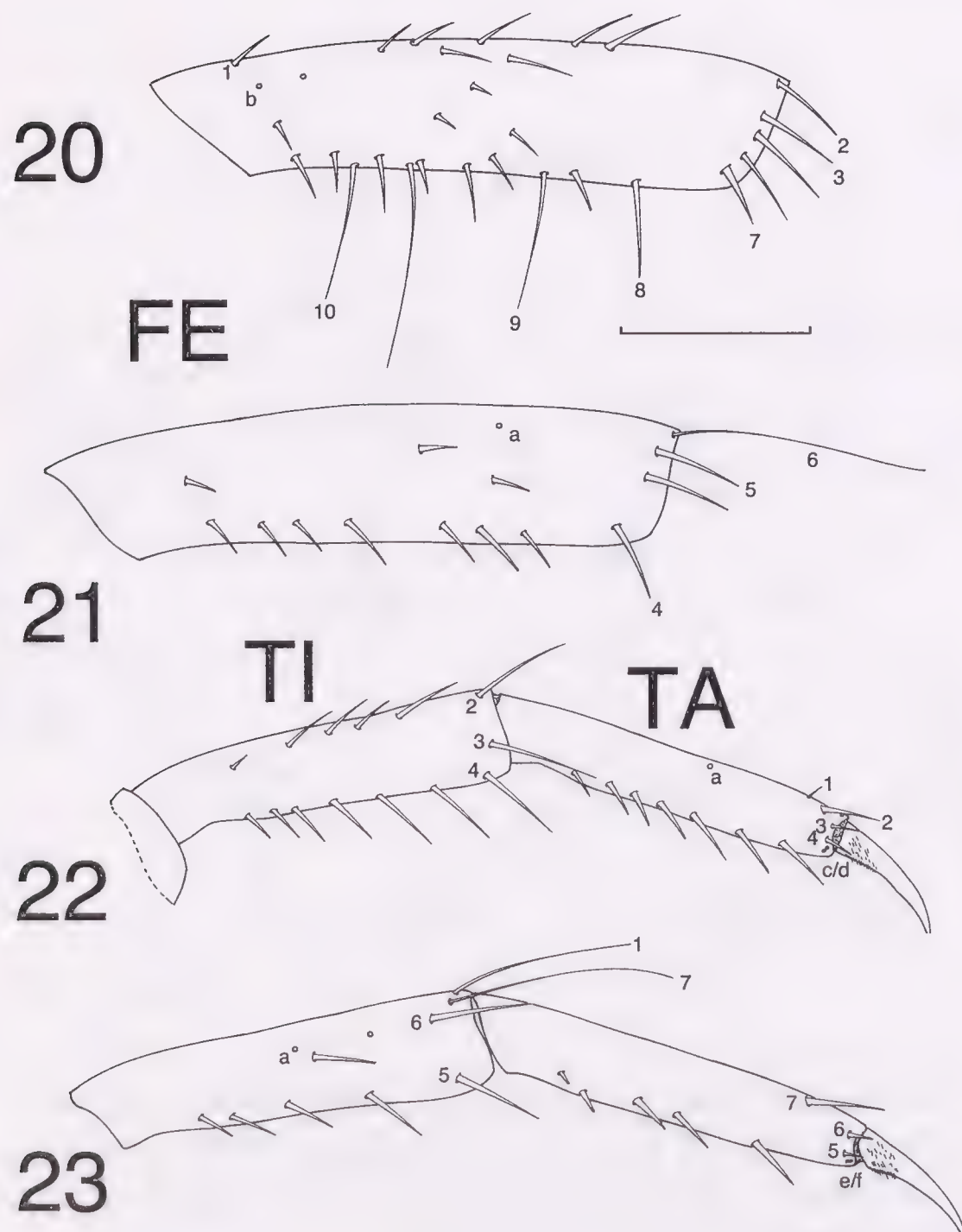
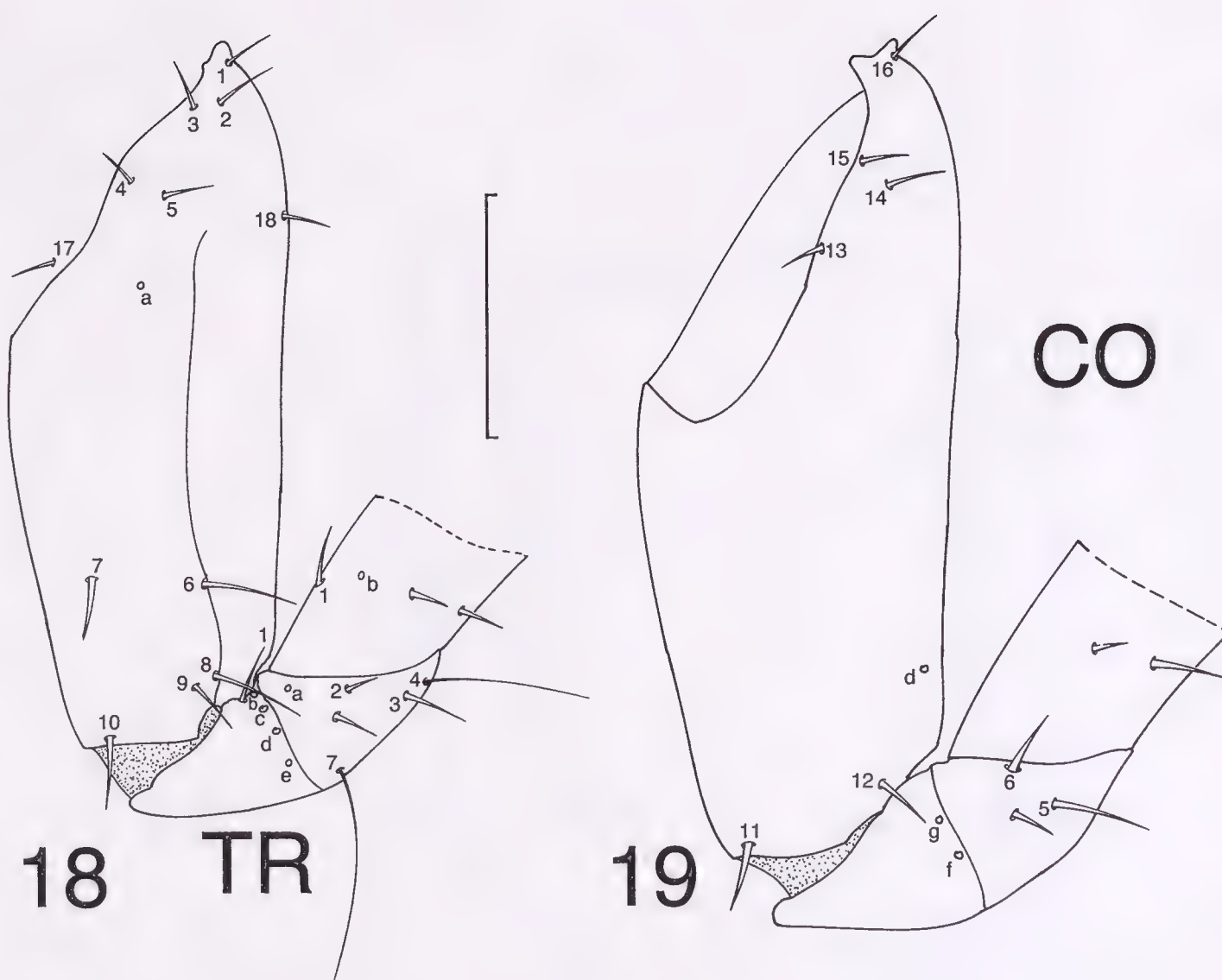
Figs 11-13. Cephalic appendages of *Meladema lanio*, first instar: 11 - antenna, dorsal aspect; 12 - antenna, ventral aspect; 13 - mandible, dorsal aspect. Abbreviations: AN = antenna; MN = mandible. Numbers and lowercase letters refer to primary setae and pores, respectively, non-coded setae refer to additional setae. Scale bar = 0.50 mm.



Figs 14-17. Cephalic appendages of *Meladema lanio*, first instar: 14 - labium, dorsal aspect; 15 - labium, ventral aspect; 16 - maxilla, dorsal aspect, 17 - maxilla, ventral aspect. Abbreviations: LA = labium; MX = maxilla. Numbers and lowercase letters refer to primary setae and pores, respectively, non-coded setae refer to additional setae. Scale bar = 0.50 mm.

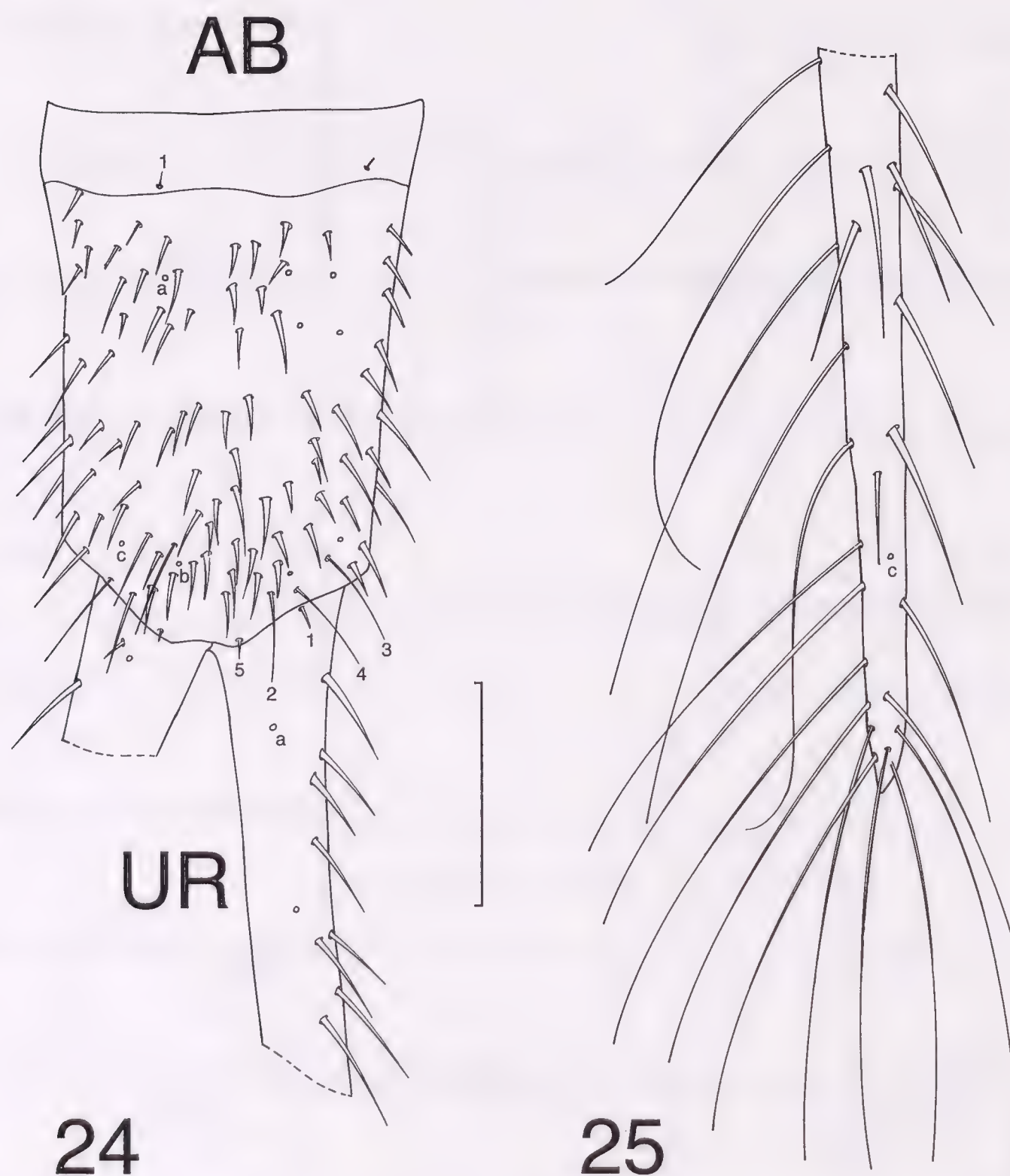


Figs 18-19. Proximal portion of the mesothoracic leg of *Meladema lanio*, first instar: 18 - anterior surface; 19 - posterior surface. Abbreviations: CO = coxa; TR = trochanter. Numbers and lowercase letters refer to primary setae and pores, respectively; non-coded setae refer to additional setae. Scale bar = 0.50 mm.



Figs 20-23. Distal portion of the mesothoracic leg of *Meladema lanio*, first instar: 20 - anterior surface of femur; 21 - posterior surface of femur; 22 - anterior surface of tibia and tarsus; 23 - posterior surface of tibia and tarsus. Abbreviations: FE = femur, TA = tarsus, TI = Tibia. Numbers and lowercase letters refer to primary setae and pores, respectively; non-coded setae refer to additional setae, pretarsus not represented. Scale bar = 0.50 mm.





Figs 24-25. Dorsal aspect of last abdominal segment and urogomphus of *Meladema lanio*, first instar: 24 - last abdominal segment; 25 - distal portion of urogomphus. Abbreviations: AB, last abdominal segment, UR, urogomphus. Numbers and lowercase letters refer to primary setae and pores, respectively; non-coded setae refer to additional setae. Scale bar = 0.50 mm.



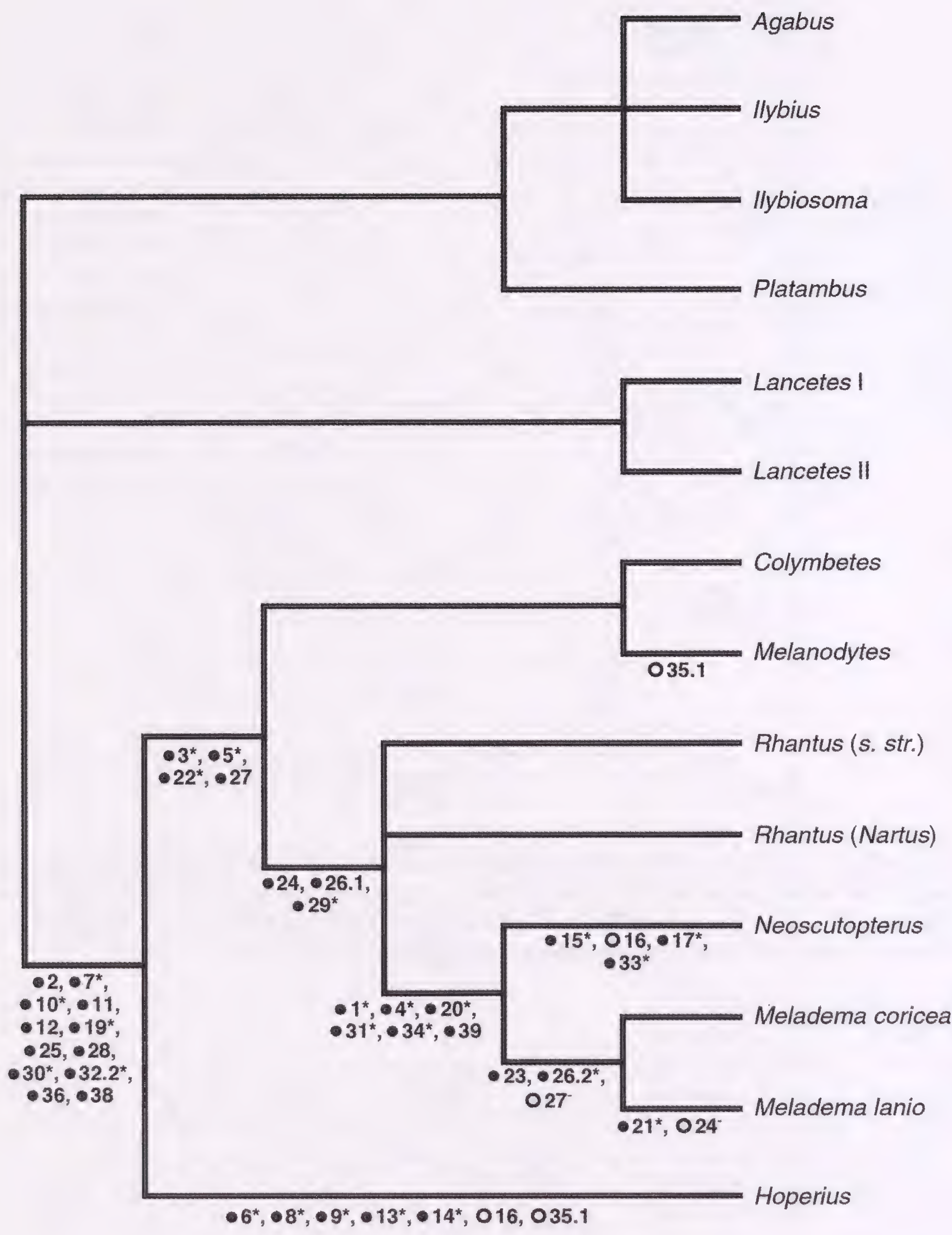


Fig. 26. One of the 12 most parsimonious trees found from cladistic analysis of the matrix in tab. 2 after removal of uninformative characters (tree length = 40 steps, CI = 0.83; RI = 0.93). Character codes (as in tab. 2) above branches refer to unique character-state transformations (●) or homoplasious character-state transformations (○). \*, unambiguous character change (i.e. found only in the group and unreversed; -, reversed from the derived condition).



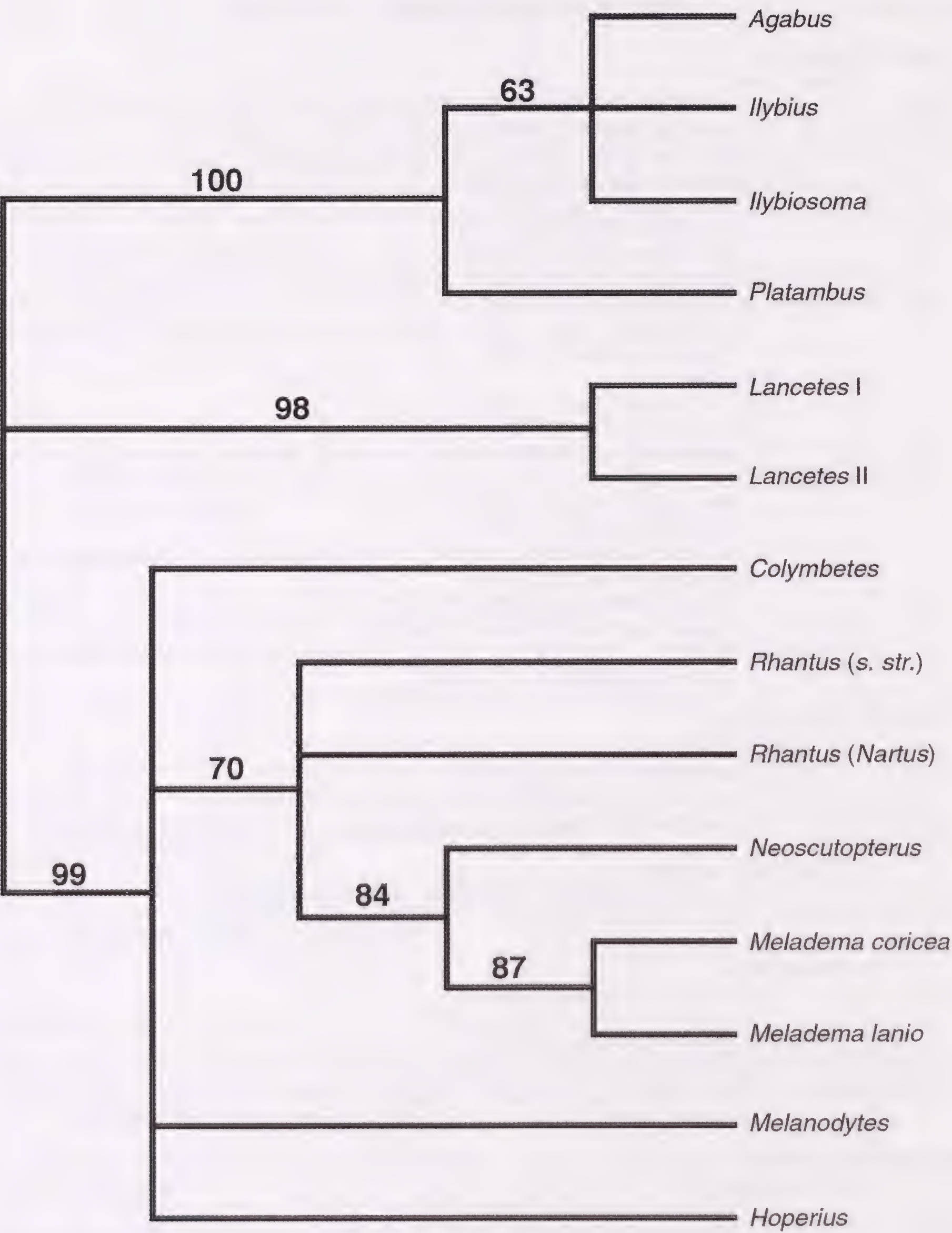


Fig. 27. Bootstrap consensus tree for 6 genera of Colymbetini based on larval characters.



## Appendix 1: list of taxa used in the phylogenetic analysis.

## Subfamily Agabinae

*Agabus* Leach

- A. anthracinus* Mannerheim, 1852
- A. arcticus* (Paykull, 1798)
- A. bifarius* (Kirby, 1837)
- A. confinis* (Gyllenhal, 1808)
- A. discolor* (Harris, 1828)
- A. elongatus* (Gyllenhal, 1826)
- A. falli* (Zimmermann, 1934)
- A. phaeopterus* (Kirby, 1837)
- A. semipunctatus* (Kirby, 1837)
- A. strigulosus* (Crotch, 1873)
- A. subfuscatus* Sharp, 1882

*Ilybiosoma* Crotch

- I. bjorkmanae* (Hatch, 1939)
- I. roguus* (Larson, 1997)
- I. seriatum* (Say, 1823)

*Ilybius* Erichson

- I. angustior* (Gyllenhal, 1808)
- I. biguttulus* (Germar, 1824)
- I. picipes* (Kirby, 1837)
- I. subaeneus* Erichson, 1837
- I. vittiger* (Gyllenhal, 1827)
- I. wasastjerna* (C. R. Sahlberg, 1824)

*Platambus* Thomson

- P. glabrellus* (Motschulsky, 1859)

## Subfamily Colymbetinae

*Colymbetes* Clairville

- C. dolabratus* (Paykull, 1798)
- C. minimus* Zaitzev, 1908 (from Shaverdo, 2003).
- C. paykulli* Erichson, 1837
- C. sculptilis* Harris, 1829

*Melanodytes* Seidlitz

- M. pustulatus* (Rossi, 1792) (from De Marzo, 1974).

*Neoscutopterus* J. Balfour-Browne

- N. hornii* (Crotch, 1873)

*Rhantus* Dejean

- R. binotatus* (Harris, 1828)
- R. consimilis* Motschulsky, 1859
- R. grapii* (Gyllenhal, 1808)
- R. formosanus* Kamiya, 1938
- R. suturellus* (Harris, 1828)
- R. wallisi* Hatch, 1953

## Subfamily Lancetinae

*Lancetes* Sharp

- L. angusticollis* (Curtis, 1839) (II)
- L. delkeskampii* Ríha, 1961 (I)
- L. subseriatus* Zimmermann, 1924 (II)

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Fig. 1. *Parabathyscia (P.) fiorii* Capra, holotype ♂: habitat.

Figs. 2-5. *Parabathyscia (P.) fiorii* Capra (♂; Firenze: Fiesole): 2 - aedeagus, dorsal view; 3 - idem, lateral view; 4 - apex of right paramere; 5 - antenna.

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Binaghi G., 1951 - Coleotteri d'Italia. Vita, ambienti, utilità, danni, mezzi di lotta. Briano, Genova, 210 pp.

Mohr K. H., 1966 - 88. Familie: Chrysomelidae, pp. 95-299. In: H. Freude, K. W. Harde & G. A. Lohse (eds.). Die Käfer Mitteleuropas, 9, Goecke & Evers, Krefeld.

Ciceroni A., Puthz V. & Zanetti A., 1995 - Coleoptera Polyphaga III (Staphylinidae), 65 pp. In: A. Minelli, S. Ruffo & S. La Posta (eds.). Checklist delle specie della fauna italiana, 48, Calderini, Bologna.

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- Poggi R.  
BIBLIOGRAFIA DI MARIO ENRICO FRANCISCOLO 3
- Bennas N. & Sàinz-Cantero C. E.  
COLÉOPTÈRES AQUATIQUES ADEPHAGA DE LA CHAÎNE RIFAINE MAROCAINE  
(Coleoptera Gyrinidae, Haliplidae, Noteridae,  
Hygrobiidae, Dytiscidae) 31
- Foster G. N. & Taylor M. J.  
THE HYDRADEPHAGA OF CHIOS, GREECE  
(Coleoptera Gyrinidae, Haliplidae, Noteridae, Dytiscidae) 75
- Dettner K.  
ADEPHAGAN WATER BEETLES OF ELBA ISLAND (TUSCANY)  
(Coleoptera Haliplidae, Dytiscidae, Noteridae, Gyrinidae) 85
- Bilardo A. & Rocchi S.  
COLEOTTERI IDROADEFAGI DEL PARCO NAZIONALE D'ODZALA  
(REPUBBLICA DEL CONGO)  
(Coleoptera Haliplidae, Dytiscidae, Noteridae) 123
- Millán A., Abellán P., Ribera I., Sánchez D. & Velasco J.  
THE HYDRADEPHAGA OF THE SEGURA BASIN (SE SPAIN):  
TWENTYFIVE YEARS STUDYING WATER BEETLES  
(Coleoptera) 137
- Valladares L. F. & Miguélez D.  
PRIMEROS DATOS SOBRE LA FAUNA DE COLEÓPTEROS ACUÁTICOS DE LOS  
HUMEDALES DEL ACUÍFERO DE LOS ARENALES (MESETA NORTE, ESPAÑA)  
(Coleoptera Adephaga y Polyphaga) 159
- Powell J. E. & Angus R. B.  
A CHROMOSOMAL INVESTIGATION OF SOME EUROPEAN SPECIES OF HALIPLIDAE  
(Coleoptera) 173
- Toledo M.  
CONSIDERAZIONI PRELIMINARI SUI CICLI VITALI E STRATEGIE RIPRODUTTIVE  
DI ALCUNE SPECIE DI DYTISCIDAE NELLA PIANURA PADANA  
(Coleoptera) 187
- Biström O. & Nilsson A.  
TAXONOMIC REVISION OF THE ETHIOPIAN GENUS *CANTHYPORUS*  
(Coleoptera Dytiscidae) 209
- Alarie Y. & Hughes S.  
RE-DESCRIPTIONS OF LARVAE OF *HOPERIUS* AND *MELADEMA*  
AND PHYLOGENETIC IMPLICATIONS FOR THE TRIBE COLYMBETINI  
(Coleoptera Dytiscidae) 307

REGISTRATO PRESSO IL TRIBUNALE DI GENOVA AL N. 76 (4 LUGLIO 1949)

Prof. Cesare Conci - Direttore Responsabile

Spedizione in a.p. - 70% - Quadrimestrale

Stampato da Litografia Solari - Via Lambro, 7/15 - 20068 Peschiera Borromeo

